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April 9, 2010

Mr. Bill Wentworth
Waste and Chemicals Management Division (3WC23)
USEPA Region III
1650 Arch Street
Philadelphia, PA 19103

Mr. Thomas Bass
West Virginia Department of Environmental Protection - OER
Office of Waste Management
601 57th Street, SE
Charleston, WV 25304-2345 *via Overnight Delivery*

Reference: Interim Measures Work Plan
Solutia Site; 1 Monsanto Road
Nitro, West Virginia
EPA ID. No. WVD039990965

Dear Bill and Tom,

Attached you will find responses to comments that were provided to Solutia on February 10, 2010 by the US EPA and the West Virginia DEP in regard to our November 3, 2009 submittal, "*Interim Measures Work Plan*" for our Nitro, WV site. Also enclosed is the revised work plan which incorporates the changes to address the Agencies' comments. Solutia's responses to comments and revised plan have been prepared in accordance with the direction provided by the US EPA and the West Virginia DEP at our meeting held with the Agencies in Charleston on March 25, 2010. The work plan includes a revised RCRA Corrective Action Schedule. Please note that you will also receive via e-mail a redline version of the work plan for assistance with your review.

Solutia looks forward to beginning the implementation of these measures. If you have any questions regarding this submittal, please call me at (314) 674-6717 or I can be reached via e-mail at mlhous1@solutia.com.

Sincerely,

Michael House

Michael L. House
Manager, Remedial Projects

Solutia Inc.

Attachments

cc: Ron Potesta, Mike Light – Potesta & Associates

Interim Measures Work Plan
November 9, 2009

Response To Comments

JOEL HENNESSY COMMENTS

1. ***The interim measures proposed are final, permanent components of what will ultimately be considered the final remedy for this site. Will an EPA remedy decision-making process with a public comment period be provided?***

Response:

If the currently proposed Interim Measures (IMs) or some evolution of these measures are successful in achieving the Corrective Measures Objectives, all elements of the Corrective Action process, including public comment, will be required before the IMs could be accepted as final Corrective Measures. At that time, the current uncertainty will have been removed and the Agencies will have the empirical data to demonstrate the effectiveness of the measures being proposed for selection as Final Corrective Measures. If the Interim Measures Objectives (IMOs) are not being achieved by the measures initially installed, additional measures will be developed at the time when this conclusion is reached.

In addition, the proposed IM approach will provide an opportunity for contemporary public comment. A formal public notice / comment process will be required on modifications to the Site NPDES Stormwater Permit (WV/NPDES Permit No. WV0116181). The public comment process is necessitated by the intrusive activities associated with implementation of the proposed IMs. This procedural step will provide the public with notice of the IM activities planned for the Site and an opportunity to comment. It is West Virginia Department of Environmental Protection's (WVDEP) standard procedure to conduct a public meeting if sufficient interest is expressed by the public on an NPDES permit application.

2. ***Table 4-1 and 4-2 indicate that pumping within the containment areas will be conducted to maintain inward gradients. How will these be measured? Will inboard and outboard piezometers be installed around the barrier wall perimeters to demonstrate the inward gradient and to trigger pumping? What will be the performance standard for an inward gradient?***

Response:

Inboard and outboard piezometers will be installed to measure the inward gradient and to trigger groundwater pumping. An inward gradient of 6" will be the targeted minimum. A detailed

design package that includes the containment area monitoring system will be presented for the Agencies' approval.

3. ***Table 4-1 and 4-2 indicate that there will be pumping within PDA containment area for LNAPL recovery. Why is LNAPL recovery needed inside the PDA containment area?***

Response:

A review of the LNAPL recovery over the past three years reveals that the rate of LNAPL recovery has substantially declined to 10 to 15 gallons per year. Solutia concurs that additional LNAPL recovery post-containment is not necessary.

IM W/P Modifications:

Table 4-1 - The referenced statement will be modified as follows:

"Pumping within the contained area to maintain inward gradient with on-site or off-site groundwater treatment; ~~and pumping of LNAPL within the PDA with off-site treatment~~."

Table 4-2 - The referenced statement will be modified as follows:

"Containment of the PDA with a Barrier Wall and Low-Permeability (WV33CSR1 - Subtitle C) Cap. Pumping within contained area to maintain inward gradient ~~and recover LNAPL with on-site or off-site groundwater and LNAPL treatment~~."

4. ***Table 4-2 Institutional Controls - The environmental covenant should be acquired after all components of the remedy are constructed and the other remedial components are finalized. The covenant should map out all constructed engineering controls and associated use restrictions for those specific units as well as for site-wide restrictions.***

Response:

Agreed.

IM W/P Modifications:

The following sentence will be added to Table 4-2, Footnote 1:

"The environmental covenant will be acquired after all components of the remedy are constructed and all remedial components finalized. The covenant will map out all constructed engineering controls and associated use-restrictions for those specific units and for site-wide restrictions."

5. ***Table 4-1 proposes a Low Permeability Cover over the Former 2,4,5-T Manufacturing Area, but Table 4-2 indicates it will be a Low Permeability Cap.***

Response:

Agreed – "Low-Permeability Cover" is the correct term.

IM W/P Modifications:

"Cap" in the following sentence in Table 4-2 will be replaced with "cover":
"Low-Permeability ~~Cap~~ Cover over the Former 2,4,5-T Manufacturing Area."

6. ***Table 4-1: Could the low permeability covers over 2,4,5-T Building demolition debris areas be eliminated (and the number of cover areas minimized) by excavating these smaller specific areas and placing the excavated material within larger containment areas?***

Response:

Solutia's evaluation concludes that excavation and relocation of the 2,4,5-T Building demolition debris areas is neither more cost-effective nor more protective vs. containment with the Low-Permeability Cover in-place.

7. ***Table 4-1 and 4-2: The proposed interim measures include containment of the Old Nitro Dump/Waste Pond with a barrier wall and low permeability cap, but Figure 4.2 indicates there are portions of the Old Nitro Dump which will not be within the barrier wall (I64 overlies a portion of the dump). Is the portion of the dump not to be contained a source of Constituents of Concern (COCs) to the River? Will waste material in the Nitro Dump become saturated by rising groundwater levels outside the proposed containment wall as a result of changing groundwater flow (see comment 9, below)?***

Response:

The areal extent of the proposed containment of the Old Nitro Dump/Waste Pond with a barrier wall and Low-Permeability Cap encompasses the portion of the Old Nitro Dump that lies outside of the footprint of I-64 Interstate ROW – as well as the Waste Pond. Solutia is not aware of any source of COCs from the portion of the Old Nitro Dump that would continue to lie outside of the contained portion of the Old Nitro Dump.

The elevation of the groundwater flowing east to west in the vicinity of the Old Nitro Dump, discharging into the Kanawha River, is not expected to be significantly affected by installation of the barrier wall around the Old Nitro Dump. The river elevation is maintained at a relatively steady 566'msl (normal pool) and this elevation is expected to exert the controlling influence on the groundwater level – including the portion of the Old Nitro Dump under the footprint of I-64. However, to confirm this expectation, and as discussed in more detail in Response to Comment 9 below, Solutia will be developing a groundwater model for the Site that will assess the effects of the IMs on groundwater level, flow direction, etc.

8. ***The specifications for the soil bentonite wall are shown in Table 4-3. What soil will be used to mix with the bentonite? Soil from the trench excavation? In some areas (Old Nitro Dump, for example) the wall is proposed to go through waste material which should not be used in containment wall material. Other areas may encounter old underground utilities or highly contaminated soils. How will these materials be dealt with?***

Response:

Following approval of the IM Work Plan (WP), Solutia will submit the following deliverables for Agencies' approval: 1) Barrier Wall Pathway Geotechnical Investigation; and 2) Barrier Wall Pathway Clearing / Slurry Wall Installation Design Package. The general objective of the geotechnical investigation is to procure sufficient information to inform the pathway clearing and slurry wall design and bidding steps that will follow. Some specific information to be obtained by the geotechnical investigation includes:

- Soils conditions - Representative soil samples will be collected for slurry wall vendors' determination of optimum soil-bentonite mixture.
- Depths to bedrock.
- Bedrock core samples will be collected to assess hardness and competency of the bedrock bottom.

Any soils that must be excavated for construction of the slurry wall, but cannot be used in the slurry mix for any reason (contamination or excess), will be placed under the Low-Permeability Subtitle C Caps over the respective containment areas. If clean soils are required for a specific area to obtain slurry wall design specifications, clean fill will be imported from off-site.

9. ***Figure 5.1 shows existing and proposed monitoring wells for measuring interim measures effectiveness. The installation of the soil bentonite barrier walls will alter groundwater flow under the site. A flow model should be developed to provide insight on the potential effects of flow changes from wall construction to determine whether the proposed monitoring network locations would be appropriate or if additional monitoring locations will be needed.***

Response:

Agreed.

IM W/P Modifications:

The following statement will be added to Table 4-2 "Proposed Interim Measures" in the "IM Effectiveness Monitoring" line:

> *"A groundwater flow model will be developed to assess the effects of flow changes from barrier wall construction and to determine the need and optimum location for additional groundwater monitoring wells."*

10. ***This work plan does not provide many of the details usually provided in a work plan. It appears to be more of a proposal for what the components of interim measures will be. Will task-specific work plans and design documents be submitted? The last sentence in Section 6.1 indicates that detailed design plans for the barrier walls, caps and covers will be submitted for agency review and approval pursuant to the enclosed schedule, but I could not find these specific deliverables listed in the schedule. Will we also get to review work plans for other work, such as the pre-design geological investigation?***

Response:

Detailed design plans for the barrier walls, caps and covers will be developed and submitted for Agencies' review / approval. The RCRA deliverable schedule included in Section 6 of the IM WP presents timing for schedule milestones. Detailed schedules with specific itemized deliverables will be developed for Agencies' review / approval for each milestone - following approval of the IM WP.

11. ***The work plan should indicate that the proposed barrier wall containment areas are technically impracticable to clean up, and that is the reason for this particular remedy.***

Response:

Agreed.

IM W/P Modifications:

The following will be added to **Section 4.0 INTERIM MEASURES**:
"As described in Sections 2 & 3, Solutia has developed a clear understanding of the nature and extent of wastes and affected media on-site. This knowledge, coupled with remedial experience under CERCLA and RCRA programs indicate that removal and disposal and/or onsite treatment of source and waste disposal areas at this Site is impracticable for the following reasons:

- *The presence of 2,3,7,8-TCDD in Site environmental media and the unavailability of offsite treatment / disposal alternatives within the United States*
- *The areal and vertical extent of affected media*
- *The overall volume of affected soils, waste and groundwater on this 116-acre site*
- *Heterogeneity of wastes in source areas*

In sites characterized by these types of conditions, Section 300.430(a)(iii)(B) of the NCP establishes that engineering controls, such as containment, coupled with monitoring, institutional controls, etc. are appropriate remedial actions. Therefore, containment-in-place is proposed to control the major Site source areas to prevent the potential for off-site transport of COCs and to mitigate potential exposure pathways. Lesser affected soils and groundwater outside of the major source areas will be monitored and managed-in-place. All Site soils will receive covers to mitigate potential COC exposure pathways and to prevent potential transport of COCs off-site.

Installation of the IMs will be followed by implementation of an Interim Measures Effectiveness Monitoring Plan (IM-EMP). The IM-EMP will provide evaluation information to be used to assess the short-term and long-term protectiveness of the IMs and the ability of the IMs to meet Site Corrective Action Objectives."

12. The plan should include a schematic cross section showing the proposed remedy components, i.e., barrier wall construction details, depth, caps, covers, etc.

Response:

Agreed. Detailed design plans for the barrier walls, caps and covers will be developed and submitted for Agencies' review / approval following approval of the IM WP.

RUTH PRINCE COMMENTS

Comment for RPM Bill Wentworth and WV PM Tom Bass

The use of interim measures as the presumptive remedy for the Solutia site is problematic from the perspective of interested parties and the public. This is a remedy that will definitely generate public interest and comments, which must be taken into account in the Agencies' decision-making process. Therefore, these interim measures cannot be implemented prior to the opportunity for the public to have input; otherwise it will appear to have been a fait accompli. The obvious solution to this is to require Solutia to revise this "Work Plan" into a presumptive remedy-style CMS.

Response:

See "Response" to Joel Hennessy Comment #1.

1. General Comment

The title of this document is inaccurate. This document is not a work plan, with specifications, design details, schedules, etc. Instead, it is an Interim Measures Conceptual Plan. Please revise the title accordingly, and revise the text and Section 6 schedule to include all actual work plan deliverables to the Agencies for each component of the interim measures.

Response:

The IM WP presents the basis and an overview of work that will be performed at the Site via Interim Measures to address environmental media issues identified during the multiple RCRA investigations. Detailed design plans and specifications for the barrier walls, caps and covers will be developed and submitted for Agencies' review / approval, following Agencies' approval of the proposed IM WP.

The RCRA deliverable schedule included in Section 6 presents milestone events for implementation of the IMs. Detailed schedules for specific deliverables will be developed for Agencies' review / approval for each milestone - following approval of the IM WP.

2. ***Section 2.4, Sediments***

Regardless of the CERCLA Order Kanawha River study being conducted by Monsanto, the Solutia RCRA Facility Investigation Reports include sediment data clearly showing contaminant release to river sediments adjacent to the Solutia facility, at concentrations with potential human health and ecological consequences. This release must be adequately addressed in the interim measures/final remedy for the Solutia facility. Furthermore, since the on-site interim measures/final remedy includes a great deal of capping, this same methodology could be used to contain consolidated aquatic sediment that requires removal from the river environment adjacent to Solutia. Management of this dioxin contaminated sediment will face the same hurdles of managing any dioxin contaminated material, and thus is a good candidate for on-site management and capping.

Response:

Agreements between New Monsanto and Solutia concerning legacy remedial issues associated with the Nitro Site delineate responsibilities between the two companies[1]. With respect to sediments, the delineation is bounded by the Site boundary at the river. New Monsanto is responsible for issues associated with the river, including Kanawha River sediments. With oversight by the USEPA and WVDEP, and pursuant to a CERCLA order[2], New Monsanto is addressing environmental issues associated with historical releases of 2,3,7,8-TCDD in the Kanawha River, including sediments. Solutia is responsible for the RCRA Site including the river bank down to the water's edge. New Monsanto's October 29, 2009, Draft Engineering Evaluation / Cost Analysis (EE/CA) Report addressing the Kanawha River Site is consistent with this delineation of responsibility. Sediment data collected by Solutia has been provided to Monsanto and incorporated into the EECA Report.

Solutia reiterates its intent to cooperate and coordinate its future actions with the Agencies and New Monsanto – whatever remedies are ultimately approved.

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[1] Mike to provide citation

[2] Administrative Order by Consent (AOC) (**CERC-03-2004-0171DC**)– "In March 2004, EPA, Monsanto and Pharmacia entered into an Administrative Order on Consent to conduct an Engineering Evaluation and Cost Analysis (EE/CA) on dioxin-contaminated sediment at the Kanawha River Site. The goal of the EE/CA is to characterize the nature and extent of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD) contamination in the Kanawha River Site that has been and/or is currently being released from what is now the Flexsys plant. 2,3,7,8-TCDD is the most toxic form of dioxin. The EE/CA will also evaluate removal alternatives, if necessary, that will protect public health, welfare, and the environment."(USEPA Kanawha River Site website: http://www.epa.gov/reg3hwmd/npl/WVSFN035516.htm)

3. Section 2.5.3, Potential Impact on Aquatic Life

a) The last paragraph of this section refers to "ongoing remediation" of the Kanawha River by New Monsanto. This is inaccurate; to date, there has been no sediment remediation associated with the Monsanto Kanawha River study.

Response:

Understood.

IM W/P Modifications:

The referenced sentence will be modified as follows:

> *"It is well documented that the water column concentrations will peak during higher flow events with the suspension of river sediments. The load to the water column currently in place due to sediment-associated 2,3,7,8-TCDD is being addressed* ***by performance of an*** ~~*ongoing remediation*~~ ***Engineering Evaluation/Cost Analysis (EE/CA)*** *by New Monsanto.* ***The EECA evaluates removal action alternatives to provide sufficient information for USEPA to determine the necessity, feasibility and efficacy of non-time critical removal actions****. Subsequent to Site IMs described herein, overall on-going 2,3,7,8-TCDD loading to the river will be substantially reduced and will minimize additional loading to the sediments."*

b) It is stated in the last paragraph of this section that "Therefore, the potential for harm to aquatic communities is unlikely to be a significant pathway in the Kanawha River . . .". This is inaccurate based solely on the sediment data collected by Solutia adjacent to the facility, which in many cases exceeds the high risk sediment concentration for fish of 100 ng/kg 2,3,7,8-TCDD TEQs (EPA/600/R-93/055). Kanawha River sediment data collected by Monsanto at other river locations also exceeds the high risk concentration. There has been no sediment remediation to date; therefore, existing sediment conditions most certainly indicate the potential for harm to aquatic communities. Please revise this text accordingly.

Response:

As stated in the Response to Comment 2, New Monsanto is responsible for the river and associated sediments and potential aquatic life issues.

IM W/P Modifications:

As the currently estimated TCDD loadings represent a fraction of that afforded the Site in the TMDL (~14% of "safe loading"), future loadings are considered to be protective of sediments which redeposit after the Kanawha River remediation. ~~*—Additionally, due to the patchy distribution of sediments and the pelagic nature of fish, the more sensitive aquatic receptor,*~~

~~*sediments in the vicinity of the property represent a fraction of the food supply. Therefore, the potential for harm to aquatic communities is unlikely to be a significant pathway in the Kanawha River and protection of the water column for contact recreation should afford the necessary level of protection to the aquatic life.*~~

4. ***Section 3.1, Area 1 – Source Areas***
This section must be revised to include a detailed explanation and justification as to why removal of the source material is not a reasonable interim measure and final remedy.

Response:

The following will be added to **Section 4.0 INTERIM MEASURES**:

IM W/P Modifications:

"As described in Sections 2 & 3, Solutia has developed a clear understanding of the nature and extent of wastes and affected media on-site. This knowledge, coupled with remedial experience under CERCLA and RCRA programs indicate that removal and disposal and/or onsite treatment of source and waste disposal areas at this Site is impracticable for the following reasons:

- *The presence of 2,3,7,8-TCDD in Site environmental media and the unavailability of offsite treatment / disposal alternatives*
- *The areal and vertical extent of affected media*
- *The overall volume of affected soils, waste and groundwater on this 116 acre site*
- *Heterogeneity of wastes in source areas*

In sites characterized by these types of conditions, Section 300.430(a)(iii)(B) of the NCP establishes that engineering controls, such as containment, coupled with monitoring, institutional controls, etc. are appropriate remedial actions. Therefore, containment-in-place is proposed to control the major Site source areas to prevent the potential for off-site transport of COCs and to mitigate potential exposure pathways. Lesser affected soils and groundwater outside of the major source areas will be monitored and managed-in-place. All Site soils will receive covers to mitigate potential COC exposure pathways and to prevent potential transport of COCs off-site.

Installation of the IMs will be followed by implementation of an Interim Measures Effectiveness Monitoring Plan (IM-EMP). The IM-EMP will provide evaluation information to be used to assess the short-term and long-term protectiveness of the IMs and the ability of the IMs to meet Site Corrective Action Objectives."

5. ***Section 3.2, Area 2 – Former Manufacturing Areas***
A permanent, permeable soil cover is proposed for Area 2. Please revise this section to reference all data for Area 2 that supports a less protective interim measure/remedy.

Response:

The RFI and Expanded RFI have fully characterized Site soils and groundwater within Area 2[3], which are areas within the Process Area that are not source areas, based on investigative results and are not disposal areas. The ERFI[4] contains the comprehensive body of investigative data results for Area 2 soils and Site groundwater. EFRI Section 5.1.1 defined the Corrective Measure Objectives (CMOs) for Area 2 as, "... protect the river from stormwater transport of 2,3,7,8-TCDD and from groundwater transport of COCs... in support of the WVAWQC for 2,3,7,8-TCDD concentration in the river of ≤ 0.014 pg/l". These same CMOs have been adopted as Interim Measures Objectives (IMOs) as well.

The IM approach to achieve the IMO is to cut off the potential pathway for soil erosion by preventing stormwater contact with the soils. The proposed IM for Area 2-Former Manufacturing Areas, is a permanent, permeable cover. The cover consists of a geotextile marker layer and an 18-inch vegetative soil layer. This proposal is essentially a BMP for stormwater. The cover will be designed with low slope factors for prevention of erosion from stormwater. In combination with proposed covenants restricting land use to commercial/industrial[5], and the proposed IM Effectiveness Monitoring Plan requiring periodic monitoring of Site surface water, the proposed IMs will be fully protective of Human Health and the Environment and are expected to meet the IMO.

6. ***Section 4.1, Interim Measures Objectives (IMOs)***
This section states that the IMOs are premised on the Site remaining industrial or commercial. Please revise to provide an analysis of future site conditions based on the USEPA OSWER Directive 9355.7-04 Land Use in the CERCLA Remedy Selection Process, specifically providing the bulleted list of information on p. 5 of this directive.

Response:

The primary objective of OSWER Directive 9355.7-04 is to, "...promote early discussions with local land use planning authorities, local officials, and the public regarding reasonably anticipated future uses of the property...". Achievement of this objective has been the subject of an on-going effort by multiple stakeholders associated with the Nitro Site. In an effort to integrate specific reuse scenarios and to facilitate redevelopment of the Site, Solutia began working with area and state redevelopment authorities in early 2007, including the Charleston Area Alliance; the WV Development Office; the Marshall University Brownfields Office; the

[3] "Area 2 – Former Manufacturing Areas" was designated as "Area 1 – Protect the River Areas", in the EFRI, dated February 17, 2007.
[4] February 16, 2007 Draft Expanded RCRA Facility Investigation, as approved by an April 25, 2008 letter from William Wentworth, Remedial Project Manager, USEPA to Mr. Michael L. House, Solutia Inc.
[5] Interim Measures Work Plan, Table 4-2, "Proposed Interim Measures".

Putnam County Develoment Office; and the West Virginia Port Authority. Many of the meetings and discussions have included involvement of the WVDEP. These efforts are continuing with periodic meetings and progress updates.

To date, there is general agreement among all stakeholders associated with the Site that a residential use in the future is inappropriate; and that a commercial / industrial reuse that maintains the protectiveness of the remedies in place at the time are both appropriate and desired. Implementation of the IM WP elements will not preclude most commercial/industrial reuse scenarios.

The information suggested by the bulleted checklist on page 5 of OSWER Directive 9355.7-04 is either not applicable to the Site or is readily available if a specific redevelopment opportunity arises.

IM W/P Modifications

The first paragraph in Section 4.1 Interim Measures Objectives will be revised to read as follows:

"USEPA OSWER Directive 9355.7-04 Land Use in the CERCLA Remedy Selection Process encourages early discussions of Site stakeholders with local and area land use planning authorities, local officials, and the public regarding reasonably anticipated future uses of the property. Solutia began working with area and state redevelopment authorities in early 2007, including the Charleston Area Alliance; the W.V Development Office; the Marshall University Brownfields Office; the Putnam County Develoment Office; and the West Virginia Port Authority.

There is agreement among all Site stakeholders that a residential use in the foreseeable future is inappropriate; and that a commercial / industrial use that maintains the protectiveness of the remedies in place at the time are both appropriate and desired. Implementation of the IM W/P will not preclude commercial/industrial reuse scenarios currently being reviewed.

Therefore, Interim Measure Objectives (IMOs) have been developed for Site soils, riverbank, wastes and groundwater. The IMOs are premised on the Site remaining industrial or commercial.

7. ***Sections 4.1.3, Area 3 (Non-Manufacturing) and 4.1.4, Area 4 (Riverbank) and Table 4-1, IMOs***

Both sections and Table 4-1 state that the Area 3 and 4 IMO is to "Prevent exposures of Site users and/or trespassers to soils and debris." Please revise to reference all of the data indicating that soil and debris exposures in these areas must be controlled, and evaluate the protectiveness of the proposed controls.

Response:

Based on Site investigations and stormwater management experience, it has been shown that the potential exists for offsite transport of TCDD via the stormwater pathway. Therefore, the entire

Site will receive covers to prevent potential transport of COCs off-site. This will also control potential COC exposure pathways to affected Site soils.

8. Section 4.1.5, Site-Wide Groundwater
Since barrier walls are to be installed to eliminate discharge of groundwater contaminants to the Kanawha River, this should be added to this section as a short-term IMO. Please revise accordingly.

Response:

Agreed.

IM W/P Modifications:

Solutia proposes to modify the list of short-term IMOs for Nitro Site Groundwater as follows:

Short-term IMOs for the Nitro site groundwater include:

- *Eliminate the potential for groundwater transport of COCs from major site source areas. Monitor concentrations of 2,3,7,8-TCDD and PCE and its breakdown products in groundwater to confirm improvement over time and:*
- *Control site groundwater use.*

9. Section 4.1.6, Aquatic Sediments and Table 4-1, IMOs
Refer to the comments above for Sections 2.4 and 2.5.3, and revise accordingly.

Response:

Please refer to Comment 2 Response.

10. Tables 4-1 through 4-3

a) Low permeability covers are proposed for the Former 2,4,5-T Manufacturing Area, the WTA Impoundments, and the WTA 2,4,5-T Building Demolition Disposal Area in Table 4-3. The primary difference between the low permeability cover and the Subtitle C Low Permeability Cap proposed for some of the source areas is that the cover lacks the cap drainage layer which ensures long-term stability in response to changing precipitation/groundwater flow regimes. Furthermore, the cover on the A3 Basin has already been super saturated and subsequently breached by a high precipitation period. Therefore, only Subtitle C caps will be considered adequate for all source areas to satisfy interim measure/final remedy requirements. Please revise accordingly.

b) Please add the following justification to Section 4.1.5 (Site-Wide Groundwater): reference and describe all groundwater data that supports the use of barrier walls for only the PDA, Process Area TCE Source Area, and the Old Nitro

Dump/Waste Pond. Explain why barrier walls are unnecessary for the other identified source areas.

c) ***Caps and covers are proposed for particular "areas." However, cap boundaries must actually be defined by soil cleanup goals. This plan must be revised to include soil cleanup goals for all relevant soil contaminants. In relation to this issue, USEPA has just released a Public Review Draft (OSWER 9200.3-56) entitled Draft Recommended Interim Preliminary Remediation Goals for Dioxin in Soil at CERCLA and RCRA Sites (December 30, 2009). The recommended interim PRGs are 72 ng/kg 2,3,7,8-TCDD TEQs for residential soils, and 950 ng/kg 2,3,7,8-TCDD TEQs for industrial soils. These PRGs must be taken into account in the development of the dioxin soil clean-up goal for the Solutia site. However, this Solutia-specific dioxin clean-up goal must also be protective of uncontrolled storm-driven sheet flow from the site to the Kanawha River.***

Response:

Please see combined Response for 10a, 10b and 10c below.

Three major COC source areas have been defined at the Site by historical knowledge and investigative results (i.e. PA PCE Source Area; PDA; and the Old Nitro Dump). These source areas are characterized by the highest concentrations of COCs at the Site in groundwater and soils and are therefore proposed to be fully contained by barrier walls keyed into bedrock in combination with caps (i.e. Subtitle C Caps).

The differentiation in the proposed caps & cover types and the areal extent of each type are driven by the variation in the need to control infiltration of stormwater. The Low-permeability Caps and barrier walls are proposed to be used for Site source areas for total containment and optimum prevention of infiltration to groundwater. Low-Permeability Covers, without containment of the groundwater, are proposed for areas of lower COC concentration in both soils and groundwater based on historical knowledge and Site investigations (i.e. Former 2,4,5-T Mfg. Area and WTA Former Impoundments). Groundwater outside of the fully contained areas will be monitored over time to insure that adequate progress is being made over time toward achievement of the sitewide groundwater IMOs identified in Table 4-1. Permanent Permeable Covers will be placed over all other areas of Site not covered by Subtitle C Caps or Low-Permeability Covers.

Site characterization has shown that the highest quantities of 2,3,7,8-TCDD transport from the Site to the Kanawha River are associated with surface water rather than groundwater. All three cap & cover types proposed for the Site will prevent the potential transport of 2,3,7,8-TCDD and other COCs via surface water. Each of the cover types will also prevent the potential for a completed contact exposure pathway between the affected (or potentially affected) soils and potential receptors (i.e. achieve the intermediate / long-term IMOs for soils and stormwater identified in Table 4-1).

Implementation of the IM-EMP will provide confirmation of the continuing effectiveness of the caps, covers and groundwater containment by requiring periodic inspection and maintenance to assure conformance to original performance specifications. The IM-EMP will also provide information to assess progress toward achievement of all intermediate/long-term IMOs identified in Table 4-1.

Future land use will be restricted to commercial/industrial via restrictive covenants[6]. Any future commercial / industrial use scenario will undergo its own review and approval process by the Agencies.

[6] This is an environmental covenant executed pursuant to the Voluntary Remediation and Redevelopment Act, West Virginia Code Chapter 22, Article 22, and the Uniform Environmental Covenants Act, West Virginia Code Chapter 22, Article 22B

FINAL
INTERIM MEASURES
WORK PLAN

Solutia Inc. Nitro Site
Nitro, West Virginia

Prepared for:

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Project No. 0101-01-0081-700A

April 9, 2010

POTESTA

TABLE OF CONTENTS

ACRONYMS AND DEFINITIONS

COCs	Constituents of Concern (i.e., constituent concentrations in Site media are greater than an established health based screening levels for that respective media)
CSM	Conceptual Site Model
DCE	Dichloroethylene
ERFI	Expanded RCRA Facility Investigation conducted in 2Q05 – 3Q06
IM	Interim Measures
IM-EMP	Interim Measures Effectiveness Monitoring Plan
IMO	Interim Measure Objective
Old Monsanto	The Monsanto Company founded in 1901
New Monsanto	The Monsanto Company first incorporated as a subsidiary of Pharmacia in 2000 and then spun off as a separate company in 2002
PA	"Process Area" within the Solutia Nitro Site
PCE	Tetrachloroethylene or "Perc"
PDA	"Past Disposal Area" within the Solutia Nitro Site
Permit	Solutia Nitro Site RCRA Corrective Action Permit (I.D. WV039990965)
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
Source Area	The Former Rubber Chemicals Manufacturing Area within the PA with high concentrations of PCE, TCE, DCE and VC in groundwater
TCDD	2,3,7,8 tetrachlorodibenzo-para-dioxin
TCE	Trichloroethylene
TEQ	TCDD Toxicity Equivalent Quotient
Solutia	Solutia Inc.
SWMU	Solid Waste Management Unit
TMDL	TCDD Total Maximum Daily Load (for TCDD)
USEPA	United States Environmental Protection Agency
VC	Vinyl chloride
WTA	Solutia Nitro Site former Wastewater Treatment Area
WVABCA	West Virginia Alcoholic Beverage Control Administration
WVAWQC	West Virginia Ambient Water Quality Criteria
WVDEP	West Virginia Department of Environmental Protection, Office of Land Reclamation

INTERIM MEASURES WORK PLAN

Solutia Inc. Nitro Site
Nitro, West Virginia

1.0 PROJECT OVERVIEW

This Interim Measure (IM) Work Plan (WP) has been prepared pursuant to the Site Resource Conservation and Recovery Act (RCRA) Corrective Action Permit, I.D. WV039990965 (Permit), Section E.2, "Interim Measures." This WP presents a basis for a recommended Scope of Work (SOW) to be completed as IMs for the Solutia Nitro, West Virginia facility (Site) soils and groundwater. The proposed IMs will be completed as part of the continuing RCRA Corrective Action program at the Site. The IMs are designed to be compatible with future site redevelopment options and anticipated final RCRA Corrective Measures. The purpose of this WP is to present an overview of the current Site conditions and to provide details related to the proposed IMs for Site environmental media.

An IM Effectiveness Monitoring Plan has been developed to be initiated following implementation of the SOW. The purpose of the monitoring plan is to assess the effectiveness of the IMs toward achievement of the objectives for Site environmental media. This monitoring plan is discussed in Section 5.0.

1.1 Site Description

Solutia's Site, formerly known as Flexsys America L.P. (Flexsys) Nitro, West Virginia, is located along the eastern (right-descending) bank of the Great Kanawha River (Kanawha River), approximately one-half mile north of the City of Nitro in Putnam County, West Virginia (Figure 1.1). The Site is a former chemical manufacturing plant, which began production of various chemical compounds in the early 1910s and continued until mid-2004. From mid-2004 through December 2005, all operating facilities were shut down, decommissioned and dismantled to grade.

The Site encompasses approximately 122 acres and is divided into two separate areas by Interstate 64: 1) a southern area encompassing approximately 76 acres, which was the former Process Area (PA) and; 2) a northern area, encompassing approximately 46 acres, which was the former Wastewater Treatment Area (WTA) and included the wastewater treatment plant and wastewater impoundments.

Characterization Information on soils, groundwater, sediments and surface water obtained during performance of RCRA Facility at the Site has been used to divide the Site into the following four areas to facilitate development of the Conceptual Site Model.

- Area 1 - Source Areas;
- Area 2 - Former Manufacturing Areas;
- Area 3 - Non-Manufacturing Areas (Parking, Administration, Warehousing and Undeveloped Land, and;
- Area 4 - Riverbank.

These areas are further described later in Section 3.0 Conceptual Site Model.

1.2 Historical Site Use

Chemical production began at the Site in 1918 when the United States Government started producing smokeless powder (nitrocellulose) for use in World War I. Nitrocellulose production ended in 1921 when the Site was purchased by the Rubber Services Company and used for the manufacturing of chloride, phosphate and phenol compounds. Monsanto Company (Old Monsanto) purchased the facility in 1929 from Rubber Services Company and added the manufacture of flotation agents, pickling inhibitors, anti-oxidants, anti-skinning, wetting agents, and oils to the existing production operations in the 1930s.

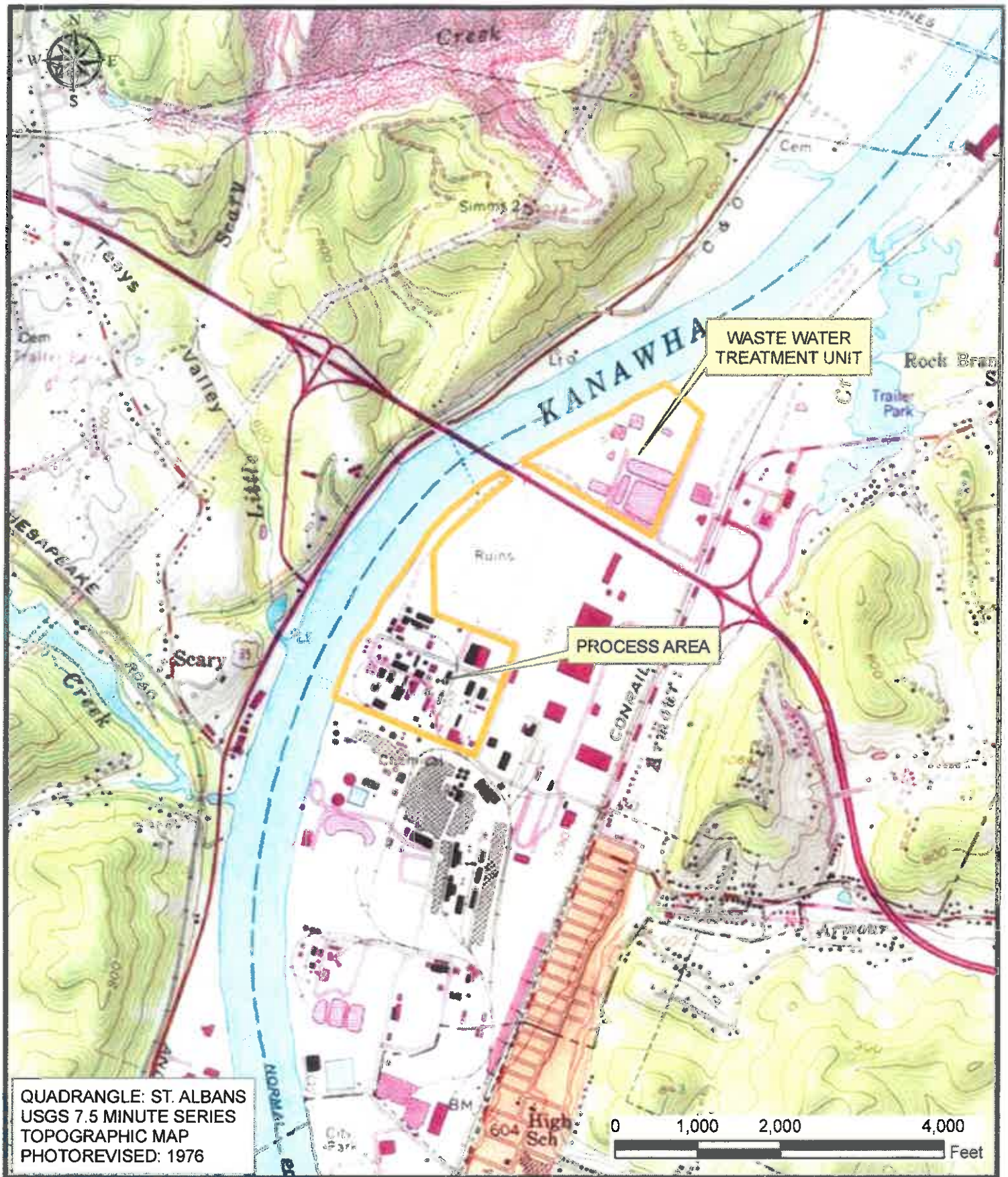
Old Monsanto continued to expand operations at the Site and accelerated its growth in the 1940s, including the production of 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) and sodium trichlorophenoxyacetic acid. A byproduct of the production of 2,4,5-T is the creation of 2,3,7,8 tetrachlorodibenzo-para-dioxin (TCDD). TCDD has been detected in surface soils at the Nitro Site. Production of the herbicide 2,4,5-T was initiated at pilot scale during the summer of 1948; plant scale production began in October 1948 in Building 34. As the demand for the herbicide increased during the Vietnam War, a new integrated facility in Building 92 was constructed and came online in August 1963. Production of the herbicide continued until demand for the product eased and production ceased at the Site in 1969. Several of the units associated with the production of the herbicide were decontaminated, demolished and buried on site during the early 1970s.

The manufacturing of rubber chemicals initially comprised about 65 percent of the Site's operations. The product line was diversified with new additions over the years, including the aforementioned herbicide production and an animal feed nutritional additive in addition to rubber chemicals including vulcanization accelerators, vulcanization inhibitors and anti-oxidants for miscellaneous rubber products. A variety of raw materials were used in the multiple chemical production processes carried out at the Site over the years, including inorganic compounds, organic solvents, and other organic compounds.

All production operations, maintenance and facility management of the Nitro plant were transferred to Flexsys in 1995. This transfer agreement included the entire Site and substantially all of the assets except the improved real estate and certain limited manufacturing assets. The RCRA Permit was modified (Class I modification) to reflect the change in permittee status from Old Monsanto to both Old Monsanto and Flexsys. In 1997, Old Monsanto spun off its chemical businesses to a newly created company called Solutia Inc. (Solutia). The equity acquired by

Solutia included Old Monsanto's interest in Flexsys, including the Nitro facility, as well as Old Monsanto's solely owned assets and liabilities at the Nitro Site. Assets included the real Site property while liabilities included responsibility for RCRA Corrective Action. In 2000, Old Monsanto entered into a merger and changed its name to Pharmacia Corporation (Pharmacia). Also in 2000, New Monsanto, based on the previous agricultural division of Pharmacia was incorporated as a standalone subsidiary of Pharmacia. In 2002, New Monsanto was spun from Pharmacia as a separate company. Pharmacia became a subsidiary of Pfizer in 2003.

In October 2003 Flexsys made a business decision to cease all chemical production at the Nitro facility. Activities began during the second quarter of 2004 to dismantle, decontaminate, and remove all surface structures including the wastewater treatment plant facility. Demolition was completed in December 2005.



POTESTA
ENGINEERS AND ENVIRONMENTAL CONSULTANTS

SCALE: AS NOTED
DATE: NOVEMBER 2009
PROJECT NO.: 01-0081-330
DRAWN: RWR
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Title

Site Location Map
Groundwater Protection Plan
Solutia Nitro Site

2.0 SUMMARY OF SITE CONDITIONS

Past site investigations, performed for the RCRA Facility Investigation (RFI) at the Site are summarized in the February 16, 2007, Expanded RFI (ERFI) Report. One conclusion of these investigations is that TCDD is migrating from the Former 2,4,5-T Manufacturing Area, the Past Disposal Area (PDA) and the Closed Wastewater Impoundments via the groundwater and/or surface water pathways and discharging to the Kanawha River (see Figure 2.0 for locations of areas and groundwater wells). Another conclusion is that tetrachloroethene (also known as perchloroethene or PCE) or its breakdown products (trichloroethylene or TCE; dichloroethene or DCE; and vinyl chloride or VC) are migrating from the Former Rubber Chemicals Manufacturing Area (Source Area) via the groundwater pathway and discharging to the Kanawha River. Migration of these constituents via the groundwater and/or surface water pathway is discussed below.

2.1 TCDD Migration

2.1.1 Groundwater Pathway

TCDD migration to the Kanawha River via the groundwater pathway was evaluated by collecting high-volume groundwater samples during April, May, June and July of 2008. Groundwater samples were collected from seven existing TCDD migration well pairs and two existing plume stability well pairs located in the PA; and four existing TCDD migration well pairs and two new TCDD migration well pairs installed in the WTA (Figure 2.0). Average concentration data from these monitoring wells were used to determine the TCDD Toxicity Equivalent Quotient (TEQ) flux from the PA (including the PDA) and the WTA to the Kanawha River via the groundwater pathway as shown below:

AVERAGE TCDD (as TEQ) Migration to River via the Groundwater Pathway (2Q08 / 3Q08 database)

TCDD Source Area and Migration Pathway	Groundwater Discharge to Surface Water (GPD)	Average Dioxin TEQ Concentration in Groundwater (pg/L)	Dioxin TEQ Flux to Kanawha River via Groundwater Pathway (ug/day)
Shallow Groundwater			
• Process Area	36	0.067	0.0000
• Past Disposal Area	206	0.153	0.0001
• Wastewater Treatment Area	328	0.654	0.0008
Deep Groundwater			
• Process Area	7,017	0.008	0.0002
• Past Disposal Area	2,447	0.037	0.0003
• Wastewater Treatment Area	9,049	0.195	0.0067
Total Average Dioxin TEQ Flux to the Kanawha River via the Groundwater Pathway			**0.0082 ug/day**

Based on this evaluation, the average TCDD flux (as TEQ) from the Site to the Kanawha River via the groundwater pathway is 0.05 percent of the 16.5 ug/day "safe loading level" for TCDD as defined in the TCDD Total Maximum Daily Load (TMDL) Report[1] for the Kanawha River.

2.1.2 Surface Water Pathway

As required by Site NPDES Permit No. WV0116181, Solutia currently collects quarterly stormwater samples from Outfall 001, which is located in the PA and Outfall 003 located in the WTA. Monthly stormwater samples are collected from Outfall 002, also located in the WTA (Figure 2.0). Stormwater sampling data, collected from the three outfalls in 2007, were used to determine TCDD flux from the Site to the Kanawha River via the surface water pathway:

TCDD Migration to the Kanawha River via the Surface Water Pathway in 2007

TCDD Source Area and Migration Pathway	Average Stormwater Discharge to Surface Water (GPD)	Maximum TCDD Concentration in Stormwater (pg/L)	Maximum TCDD Flux to Kanawha River via Surface Water Pathway (ug/day)
Process Area			
• **Outfall 001**	**137,000**	**2.3**	**1.203**
Wastewater Treatment Area			
• **Outfall 002**	**3,000**	**18.5**	**0.200**
• **Outfall 003**	**15,000**	**2.3**	**0.134**
• **Sheet Flow**	**13,000**	**18.5**	**0.908**
Total TCDD Flux to the Kanawha River via the Surface Water Pathway			**2.445 ug/day**

This analysis demonstrates that the maximum TCDD flux from the Site to the Kanawha River via the surface water pathway is 14.9 percent of the 16.5 ug/day "safe loading level" for TCDD.

2.2 Source Area Migration

A Source Area was detected in the Former Rubber Chemicals Manufacturing Area within the PA ("Source Area") during the CA-750 Groundwater Environmental Indicator Site investigation conducted in 2003 (See Figure 2.0). The source consisted primarily of tetrachloroethene (also known as perchloroethylene or PCE) or its breakdown products (TCE, DCE and VC). Maximum detected PCE, TCE, DCE and VC concentrations in the Source Area were 12,000 ug/L; 14,000 ug/L; 56,000 ug/L and 17,000 ug/L, respectively, in 2Q03 and 3Q03. Chlorobenzene (12,000 ug/L), ethylbenzene (12,000 ug/L) and xylene (36,000 ug/L) (maximum concentrations) were also detected in this Source Area.

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[1] *"Dioxin TMDL Development for Kanawha River, Pocatalico River and Armour Creek, West Virginia"*, dated September 14, 2000, prepared for U.S EPA Region III by Tetra-Tech, Inc. (see Page 42)

A plume stability evaluation performed for the ERFI from 2Q05 to 3Q06 confirmed the presence of a chloroethene Source Area in the Former Rubber Chemicals Manufacturing Area. However, PCE was no longer present and maximum detected concentrations of TCE, DCE and VC were 3,800 ug/L, 73,000 ug/L and 15,000 ug/L, respectively. Chlorobenzene, ethylbenzene and xylene were still present in this Source Area at maximum concentrations of 11,000 ug/L, 720 ug/L and 670 ug/L, respectively.

Quarterly Plume Stability Monitoring has continued at the Site since the ERFI sampling was completed in 3Q06. In 2Q09, TCE, DCE and VC maximum concentration in the Source Area was 1,400 ug/L, 61,000 ug/L and 7,100 ug/L, respectively. These PCE breakdown products were also present in downgradient monitoring wells adjacent to the Kanawha River at maximum detected concentrations of 1,900 (GW-4A/B); 27,000 ug/L (GW-9 A/B) and 3000 ug/L (GW-11 A/B), respectively (Figure 2.0). Chlorobenzene, ethylbenzene and xylene were also present in the Source Area at maximum detected concentrations of 1,600 ug/L, 160 ug/L and 51 ug/L, respectively. However, in downgradient monitoring wells, chlorobenzene and xylene were detected at a maximum concentration of 350 ug/L (MW-10 A/B) and 6.6 ug/L (MW-0 A/B) respectively while ethylbenzene was not detected.

Surface water sampling performed for the 2003 CA-750 Groundwater Environmental Indicator Site investigation demonstrated that groundwater discharges from the PA did not result in an exceedance of West Virginia Ambient Groundwater Quality Criteria (WVAWQC) in the Kanawha River.

2.3 Nitro Facility Sewer System

Solutia, Flexsys and the Agencies (Parties) reached an agreement in 1995 on how the Facility Sewer System Solid Waste Management Unit (SWMU) would be addressed. The agreement among the Parties was based on the following documents:

- "Facility Sewer System Stabilization Work Plan," Roux Associates, Inc. August 5, 1994.
- "Sewer Stabilization Measures Evaluation Report," Roux Associates, Inc., May 30, 1995. This report presented a comparative analysis of conceptual sewer stabilization measures alternatives.
- "Detailed Sewer Stabilization Measures Plan, Roux Associates, Inc.," November 27, 1996.

The agreement among the Parties was that Flexsys would fund an estimated $25 Million Stabilization Measure to install above grade process sewers, eliminating the use of the below grade Facility Sewer System for process wastewater streams, in lieu of further characterization and investigation of the Facility Sewer System SWMU. Installation of this Stabilization Measure pursuant to the November 27, 1996 Work Plan was nearing completion when the decision was made by Flexsys in October 2003 to discontinue operations at its Nitro facility.

As stated earlier, the decision in October 2003 to discontinue operations at the Nitro facility was followed by decontamination and dismantling of all surface structures to grade in 2004-2005. Any potential for the Nitro Facility Sewer System to intercept the groundwater and to provide a direct pathway to the river was eliminated as an element of the 2004-2005 Site demolition. During the facilities demolition phase, the Nitro Facility Sewer System was physically blocked with concrete at each drop inlet and manhole (~125 locations) throughout the Site. In addition, each Nitro Facility Sewer System outfall at the river was also physically blocked with concrete.

2.4 Sediments

Pursuant to an agreement between New Monsanto and Solutia, responsibility for the historical Kanawha River sediments and any required actions related to these sediments to protect Human Health or the Environment will be the responsibility of New Monsanto. Pursuant to a United States Environmental Protection Agency (USEPA) CERCLA order[2], New Monsanto is currently conducting studies on a section of the Kanawha River which includes the area adjacent to the Site. Kanawha River sediments are among the issues subject to that investigation.

2.5 Conclusions

2.5.1 TCDD

TCDD is migrating to the Kanawha River from the Former 2,4,5-T Manufacturing Area, the PDA and the Closed Wastewater Impoundments via the groundwater and surface water pathways. Although TCDD flux is less than 15 percent of the "safe loading level" (16.5 ug/day), migration from these source areas should be controlled because the WVAWQC for 2,3,7,8-TCDD in the Kanawha River is 0.014 pg/L, a very low number established to protect human health.

2.5.2 PCE

PCE breakdown products (TCE, DCE and VC) are migrating from the Former Rubber Chemicals Manufacturing Area and discharging to the Kanawha River via the groundwater pathway. Even though TCE concentrations in the Kanawha River downgradient of the Former Rubber Chemicals Manufacturing Area are below the 81 ug/L WVAWQC, migration from this source area should be controlled to ensure that this criterion will continue to be achieved.

2.5.3 Potential Impact on Aquatic Life

While West Virginia has no specific aquatic life numeric criteria for TCDD, the Kanawha River is protected by the application of a warm water aquatic life use designation and the protection offered by the applicable narrative criteria. In addition to meeting the applicable contact

[2] Administrative Order by Consent for Removal Action, EPA Docket No. CERC-03-2004-0171DC, Kanawha River Site, West Virginia

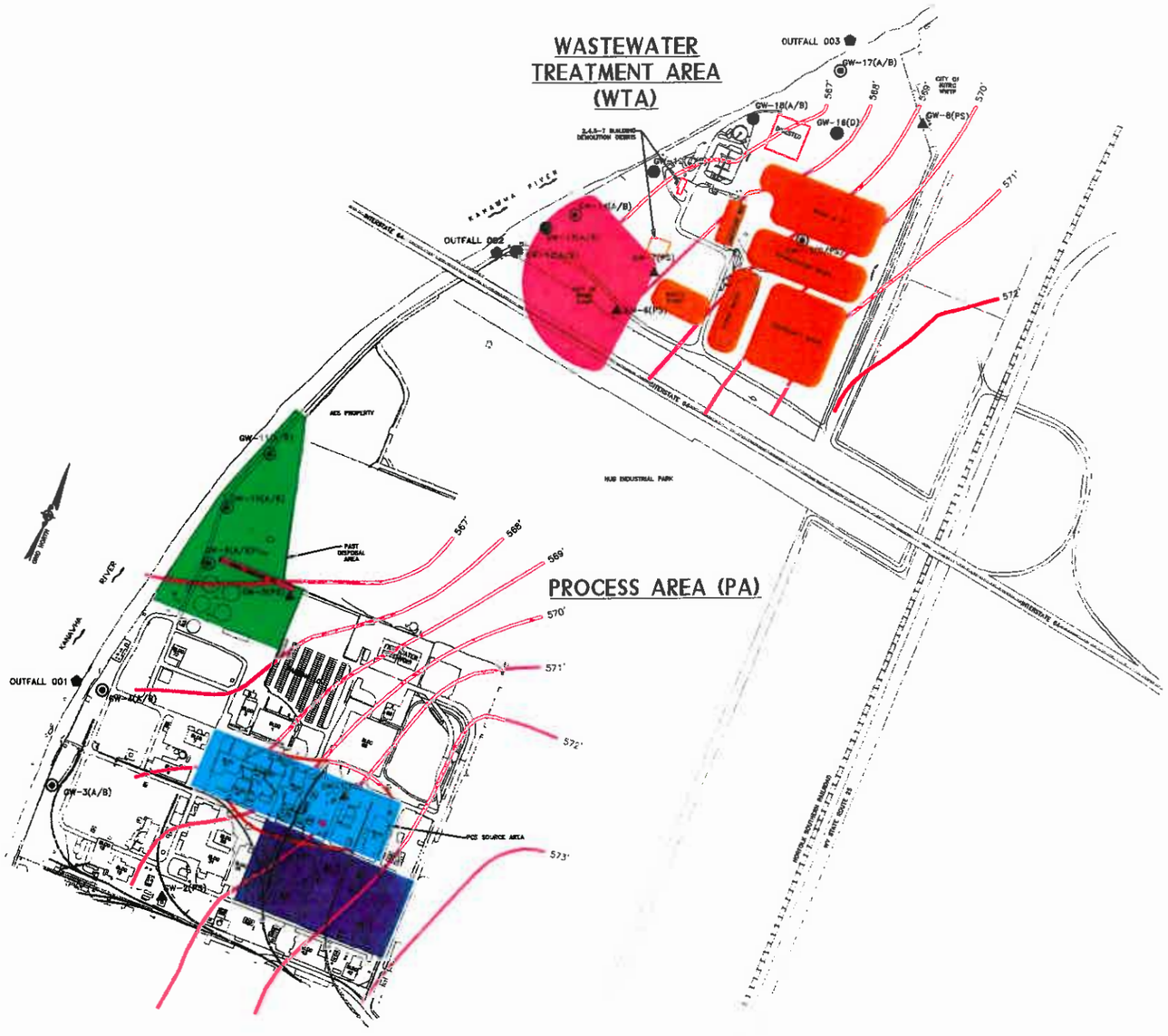
recreation criteria in the area adjacent to and downstream of the properties, the TCDD concentrations in the river must be conducive to the establishment of aquatic communities.

TCDD concentrations which can be expected to affect aquatic life have been evaluated in several studies summarized by the USEPA in 1993. This interim report on assessment of environmental risks (EPA/600/R-93-055) suggests that amphibians and invertebrates are much less sensitive to TCDD than fish, and that a water column concentration of 0.6 pg/l (conservative value based on particulate organic carbon concentration) would equate to a low risk of harm to aquatic life. As this number is well above the state's drinking water and contact recreation criteria, attainment of the water column standards should adequately protect aquatic life.

It is well documented that the water column concentrations will peak during higher flow events with the suspension of river sediments. The load to the water column currently in place due to sediment-associated TCDD is being addressed by performance of an Engineering Evaluation/Cost Analysis (EE/CA) by New Monsanto. The EECA evaluates removal action alternatives to provide sufficient information for USEPA to determine the necessity, feasibility and efficacy of non-time critical removal actions. Subsequent to Site IMs described herein, overall on-going TCDD loading to the river will be substantially reduced and will minimize additional loading to the sediments. As the currently estimated TCDD loadings represent a fraction of that afforded the Site in the TMDL (~14% of "safe loading"), future loadings are considered to be protective of sediments which redeposit after the Kanawha River remediation.

SITE COC MIGRATION SOURCE AREAS

TCDD & PLUME STABILITY MONITORING WELLS



LEGEND

- TCDD (TEQ) MIGRATION WELL CLUSTER
  - GW-17A – SHALLOW ZONE
  - GW-17B – DEEP ZONE
- PLUME STABILITY / TCDD MIGRATION DUAL USE WELL CLUSTER
- CURRENT OUTFALLS
- PLUME STABILITY WELL CLUSTER
  - GW-6 (PS) A – SHALLOW ZONE
  - GW-6 (PS) B – DEEP ZONE
- 573' GROUNDWATER ELEVATION

TCDD SOURCE AREAS

- PAST DISPOSAL AREA
- CLOSED WASTEWATER IMPOUNDMENTS
- OLD NITRO DUMP

PCE SOURCE AREA

- FORMER RUBBER CHEMICAL MANUFACTURING AREA
- PCE SOURCE AREA
- FORMER 2,4,5-T MANUFACTURING AREA

GRAPHIC SCALE

MAPPING REFERENCE:
BASE MAPPING PREPARED BY PHOTO SCIENCE, INC. FROM AERIAL PHOTOGRAPHY DATED 2/17/98.
SUBSEQUENT REVISIONS COMPLETED BY FLEXSYS AMERICA L.P.

FIG 2-1
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Approved
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OCT. 2002
Date:
01-0081-7200A
Project No.

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SOLUTIA NITRO SITE
NITRO, WEST VIRGINIA

COC MIGRATION TO KANAWHA RIVER VIA SURFACE WATER & GROUNDWATER PATHWAYS

2.0
Figure No.

3.0 CONCEPTUAL SITE MODEL

Existing information on source areas, soils, groundwater, sediments and surface water, obtained during performance of RCRA Facility Investigations and Interim Measures at the Site was used to develop the Conceptual Site Model (CSM) described in this section. This CSM divides the Site into four areas: Area 1 - Source Areas; Area 2 - Former Manufacturing Areas; Area 3 - Non-Manufacturing Areas (Parking, Administration, Warehousing and Undeveloped Land); and Area 4 - Riverbank (Figure 3-1).

3.1 Area 1 - Source Areas

Area 1 consists of two former manufacturing areas (the Former 2,4,5-T Manufacturing Area and the Former Rubber Chemicals Manufacturing Area); three waste disposal areas (PDA, Old Nitro Dump and Former 2,4,5-T Production Building Demolition Debris Disposal Area); and six closed surface impoundments in the WTA (Waste Pond, Limestone Bed, Surge Basin, Equalization Basin, Emergency Basin, and A3 Basin). The Former 2,4,5-T Manufacturing Area, the Former Rubber Chemicals Manufacturing Area and the PDA are located in the PA. The Old Nitro Dump, Former 2,4,5-T Production Building Demolition Debris Disposal Area and the closed surface impoundments are located in the WTA. Figures 3-1 and 3-2 show the areal extent of Area 1 along with the location of the individual source areas.

Process Area – Previous IMs performed in the Former 2,4,5-T Manufacturing Area (gravel, asphalt and concrete covers) and the PDA (soil and gravel cover) have improved conditions such that it is currently protective of Site users. However, because TCDD and other COCs are present in these Source areas, additional protectiveness could be attained by replacement of these temporary covers with more durable, low-permeability cover as an additional IM. Such an engineered cover would ensure long-term prevention of human exposure to source area soils and wastes and long-term control of TCDD migration from these source areas to the Kanawha River via the surface water pathway.

Installation of a low-permeability cap and barrier wall around the PDA would physically contain impacted soils and wastes and prevent migration of TCDD from this source area to the adjacent Kanawha River via the groundwater pathway.

Impacted groundwater is migrating from the PCE source in Area 1 and discharging to the Kanawha River. Migration of PCE and its breakdown products (TCE, DCE and VC) from this source area could be controlled by installing a low-permeability cap and barrier wall at the Former Rubber Chemicals Manufacturing Area.

Wastewater Treatment Area – Previous IM soil covers on the two closed waste disposal areas and the six closed impoundments in the WTA are currently protective of Site users. However, long-term permanent protection of Site users could be achieved by installation of additional IMs composed of low-permeability covers over these closed impoundments and waste disposal areas.

In June 2003 a seep was observed coming from the A3 Basin. The seep was hypothesized to have originated from unusually heavy rainfall beginning in May and June 2003 in the southern WV area, causing the 1-foot soil cover over the stabilized sludge in the A3 Basin to become saturated. As the water in the saturated soil cover traveled toward the lowest elevation point in the Basin cover, the soil became supersaturated and the seep broke out on the ground surface. The interim measure consisted of placement of a 40 mil. HDPE synthetic rain covers over the entire A3 Basin area over an additional soil cover of approximately 2 feet over the lowest point in the Basin to maintain a slope of 1% minimum. The seep has not re-occurred and water levels below the basin have dropped significantly.

3.2 Area 2 - Former Manufacturing Areas

Area 2 is comprised of the former manufacturing areas in the PA that are not included in the Former 2,4,5-T Manufacturing Area and the Former Rubber Chemicals Manufacturing Area (Figures 3.1 and 3-2). Stormwater discharging from Area 2 to the Kanawha River does not exceed the Site's NPDES Permit limits because an earlier IM, utilizing flow control, gravel and vegetated covers, gravel berms and silt fences along with existing concrete building slabs, asphalt parking lots and roadways, has effectively isolated surface water runoff contact with underlying soils. Long-term protection of public health and the environment could be achieved in Area 2 by installation of an additional IM composed of a permanent, permeable soil cover to provide a more robust protection from human contact with surface soils and limit entrainment of TCDD in stormwater runoff discharging to the Kanawha River.

3.3 Area 3 – Non Manufacturing Areas

Area 3 consists of land in the PA and WTA that was used for parking, administration, warehousing or left undeveloped (Figures 3.1 and 3.2). Soils in the PA and WTA are currently protective of human health except for TCDD concentrations at the P-07 surficial soil sampling location in the PA and the W-25 soil sampling location in the WTA[3]. Risks associated with these soil sampling locations could be controlled by additional Interim Measures consisting of consolidation of these soils within the PDA followed with installation of a permanent, permeable soil cover. As discussed above, the PDA can be contained by a barrier wall and a low-permeability cap.

3.4 Area 4 - River Bank

Area 4 is the exposed bank of the Kanawha River along the entire PA and the southern portion of the WTA (Figures 3.1 and 3.2). In 2003, an Interim Measure was performed on the river bank adjacent to the PDA to remove residue seepage material and stabilize the slope by installing geotextile and rip-rap armor. Additional improvements in the stability of the river bank could be attained by installation of an additional IM consisting of clearing and grading of the bank, followed by placement of geotextile and rip-rap armoring along the entire exposed river bank in the PA and the WTA.

[3] "Expanded RCRA Facility Investigation Report", dated February 16, 2007 Potesta and Associates, Inc.

LEGEND

- AREA 1 - SOURCE AREAS
- AREA 2 - FORMER MANUFACTURING AREAS
- AREA 3 - NON-MANUFACTURING AREAS
- AREA 4 RIVERBANK
- PCE SOURCE AREA
- RUBBER CHEMICAL MANUFACTURING AREA
- FORMER 2,4,5-T MANUFACTURING AREA

GRAPHIC SCALE

200 100 0 200 400

MAPPING REFERENCE:
BASE MAPPING PREPARED BY PHOTO SCIENCE, INC FROM AERIAL PHOTOGRAPH DATED 3/17/95
SUBSEQUENT REVISIONS COMPILED BY TETRA TECH NUS, INC.

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Scale:
SEPT. 2009
Date
01-0081-700A
Project No.

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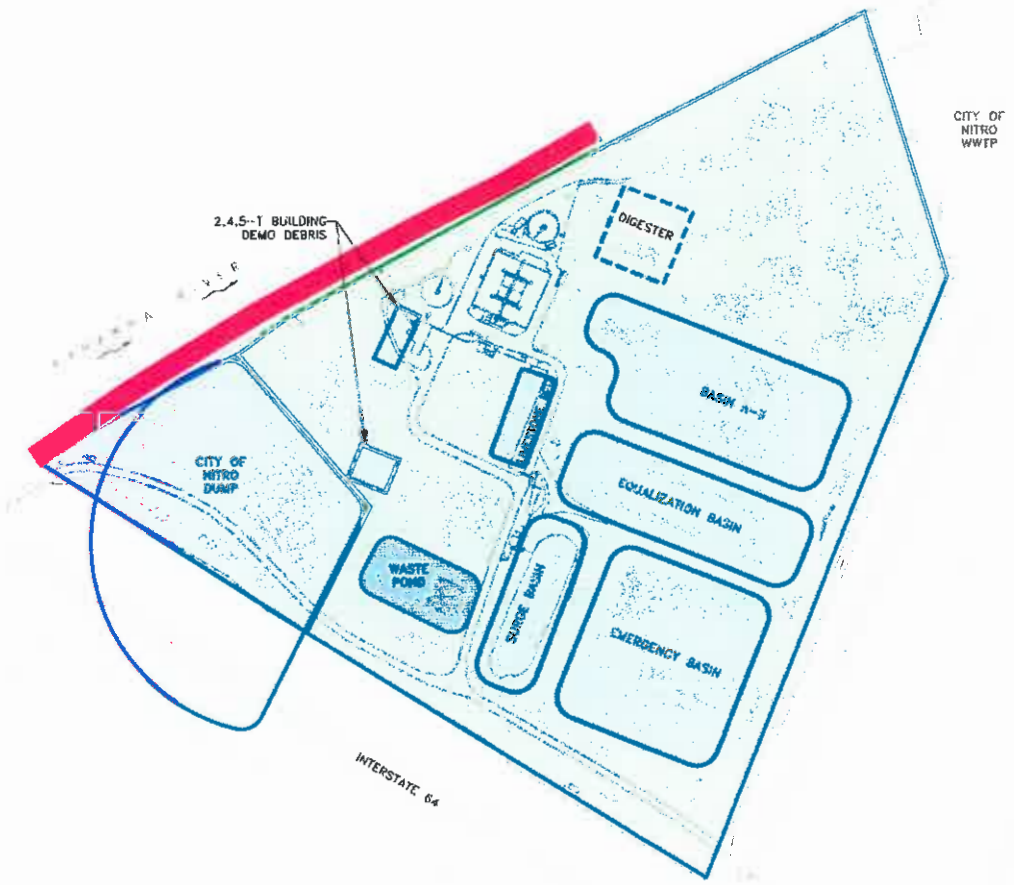
SOLUTIA NITRO SITE
NITRO, WEST VIRGINIA

PROCESS AREA
INTERIM MEASURES W/P
CONCEPTUAL SITE MODEL

3.1



LEGEND

- AREA 1 – SOURCE AREAS
- AREA 2 – FORMER MANUFACTURING AREAS
- AREA 3 – NON-MANUFACTURING AREAS
- AREA 4 RIVERBANK

GRAPHIC SCALE

200 100 0 200 400

MAPPING REFERENCE:
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SUBSEQUENT REVISIONS COMPILED BY ILLINOIS AMERICA L.P.

FIG 3.2
CAD File No

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SEPT. 2009
Date

01-0081-700A
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POTESTA

SOLUTIA NITRO SITE
NITRO, WEST VIRGINIA

WASTEWATER TREATMENT AREA
INTERIM MEASURES W/P
CONCEPTUAL SITE MODEL

3.2
Figure No.

4.0 INTERIM MEASURES

As described in Sections 2 & 3, Solutia has developed a clear understanding of the nature and extent of wastes and affected media on-site. This knowledge, coupled with remedial experience under CERCLA and RCRA programs indicate that removal and disposal and/or onsite treatment of source and waste disposal areas at this Site is impracticable for the following reasons:

- The presence of 2,3,7,8-TCDD in Site environmental media and the unavailability of offsite treatment / disposal alternatives within the United States.
- The areal and vertical extent of affected media.
- The overall volume of affected soils, waste and groundwater on this 116-acre site.
- Heterogeneity of wastes in source areas.

In sites characterized by these types of conditions, Section 300.430(a)(iii)(B) of the NCP establishes that engineering controls, such as containment, coupled with monitoring, institutional controls, etc. are appropriate remedial actions. Therefore, containment-in-place is proposed to control the major Site source areas to prevent the potential for off-site transport of COCs and to mitigate potential exposure pathways. Lesser affected soils and groundwater outside of the major source areas will be monitored and managed-in-place. All Site soils will receive covers to mitigate potential COC exposure pathways and to prevent potential transport of COCs off-site.

Installation of the IMs will be followed by implementation of an Interim Measures Effectiveness Monitoring Plan (IM-EMP). The IM-EMP will provide evaluation information to be used to assess the short-term and long-term protectiveness of the IMs and the ability of the IMs to meet Site Corrective Action Objectives.

4.1. Interim Measures Objectives

USEPA OSWER Directive 9355.7-04 **"Land Use in the CERCLA Remedy Selection Process,"** encourages early discussions of Site stakeholders with local and area land use planning authorities, local officials, and the public regarding reasonably anticipated future uses of the property. Solutia began working with area and state redevelopment authorities in early 2007, including the Charleston Area Alliance; the West Virginia Development Office; the Marshall University Brownfields Office; the Putnam County Develoment Office; and the West Virginia Port Authority.

There is agreement among all Site stakeholders that a residential use in the foreseeable future is inappropriate; and that a commercial/industrial reuse that maintains the protectiveness of the remedies in place at the time is both appropriate and desired. Implementation of the IM WP will not preclude commercial/industrial reuse scenarios currently being reviewed.

Therefore, Interim Measure Objectives (IMOs) have been developed for Site soils, riverbank, wastes and groundwater. The IMOs are premised on the Site remaining industrial or commercial.

The CSM presented in Section 3 of this work plan divides the Site into four areas, which are summarized below and shown on Figures 3.1 and 3.2:

Area 1 – Source Areas

Process Area
- Former 2,4,5,-T Manufacturing Area
- Former Rubber Chemicals Manufacturing Area
- Past Disposal Area

Wastewater Treatment Area
- Old Nitro Dump
- Former 2,4,5-T Production Building Demolition Debris Disposal Area
- Closed Surface Impoundments
  - Waste Pond
  - Limestone Bed
  - Surge Basin
  - Emergency Basin
  - Equalization Basin
  - A3 Basin

Area 2 – Former Manufacturing Areas

Those portions of the PA, formerly used for chemical manufacturing, that are not known source areas or disposal areas.

Area 3 – Non Manufacturing Areas

Land in the PA and WTA that was used for parking, administration (offices) and warehousing or left undeveloped.

Area 4 - River Bank

Area 4 is the exposed bank of the Kanawha River along the entire PA and the southern portion of the WTA. "Exposed bank" is defined as the bank face extending from the top-of-bank to normal pool on the river (566') across the site as depicted on Figures 3.1 and 3.2.

The IMOs described in the following sections are developed specific to environmental media within each Site Area.

4.1.1 Area 1 (Source Areas)

Area 1 (Source Areas) IMOs, which are presented below, are designed to control the potential for human exposure to wastes and impacted soil and groundwater in the source areas, and;

migration of TCDD and PCE (and its breakdown products) from the source areas to the Kanawha River via the groundwater and/or surface water pathways.

- Prevent exposure of current and future Site users and/or trespassers to wastes, soils and groundwater in Area 1;
- Control migration of TCDD from Area 1 to the Kanawha River such that the groundwater and surface water discharges do not exceed the "safe loading level" for the Site; and
- Control migration of PCE and its breakdown products from Area 1 to the Kanawha River such that the groundwater discharge does not cause an exceedance of WVAWQC in the river.

4.1.2 Area 2 (Former Manufacturing)

Area 2 IMOs address migration of TCDD to the Kanawha River via the surface water pathway, i.e., protect the river. IMOs for Area 2 include:

- Prevent exposure of current and future Site users and/or trespassers to Area 2 soils and groundwater; and
- Control migration of TCDD from Area 2 to the Kanawha River such that the surface water discharges do not exceed the "safe loading level" for the Site.

4.1.3 Area 3 (Non-Manufacturing)

Area 3 is either undeveloped property or has been used primarily for parking, administration or warehousing. The IMO for Area 3 is:

- Prevent exposures of Site users and/or trespassers to soils and debris.

4.1.4 Area 4 (Riverbank)

Area 4 is the exposed bank of the Kanawha River along the entire PA and the southern portion of the WTA. The IMO for Area 4 is:

- Prevent exposures of Site users and/or trespassers to soils and debris.

4.1.5 Site-wide Groundwater

USEPA's groundwater protection and clean-up strategy for RCRA Corrective Action is to address the greatest risks first and to make meaningful progress toward the ultimate goal of returning groundwater to its maximum beneficial use. USEPA also expects final remedies to control or eliminate surface and subsurface sources of groundwater contamination. The proposed IMs to control Site sources to groundwater will make progress consistent with USEPA strategy.

Short-term IMOs for the Nitro site groundwater include:

- Eliminate the potential for groundwater transport of COCs from major site source areas. Monitor concentrations of TCDD and PCE and its breakdown products in groundwater to confirm improvement over time; and
- Control site groundwater use.

The West Virginia Groundwater Protection Act [WV Code § 22-12-4(b)] states that achievement of groundwater cleanup criteria will require reasonable efforts to mitigate further releases of contaminants from SWMUs, impoundments and affected soils, using the site boundary as the point of compliance, and reduction of contaminant levels, as practicable, over time. Therefore, the long-term IMO for Site-wide groundwater is achievement of State and Federal Cleanup criteria.

4.1.6 Aquatic Sediments

As described in section **2.4 Sediments**, New Monsanto is currently conducting studies on a section of the Kanawha River which includes the area adjacent to the Site. One outcome of these studies will be a determination if a clean-up action is required to address the historical sediments along the Site river boundary - along with other Kanawha River sediments. The following Solutia IMOs will apply to aquatic sediments in the area adjacent to the Site following any clean-up actions by New Monsanto to address the historical sediments.

IMOs for aquatic sediments are summarized as follows:

- Control migration of TCDD from Area 1 to the Kanawha River such that the groundwater and surface water discharges do not exceed the "safe loading level[4]" for the Site, and;
- Control migration of PCE and its breakdown products from Area 1 to the Kanawha River such that the groundwater discharge does not cause an exceedance of the WVAWQC in the river.

IMOs for all Site environmental media are summarized in Table 4-1.

[4] 16.5 ug/day TCDD to the Kanawha River as defined in the 2001 TCDD Total Maximum Daily Load Report for the Kanawha River.

TABLE 4-1

Interim Measures Objectives
Solutia Inc. - Nitro, WV Site

AREA	Environmental Media	Interim Measures Objectives		Recommended Interim Measures
		Short-Term	*Intermediate / Long-Term*	
Area 1 - Source Areas	**Soil/wastes**	**1)** Implement Site Health and Safety Plan and Site security procedures to prevent exposure of industrial and construction workers and trespassers to source area soils and wastes prior to and during the construction of Interim Measures.	**1)** Prevent exposures of current and future Site users and trespassers to soils and wastes	**(1) Low Permeability Covers** over the Former 2,4,5-T Manufacturing Area; Former WTA Closed Lagoons (Emergency Basin, Surge Basin, Equalization Basin, A-3 Basin, Limestone Bed); and 2,4,5-T Building Demolition Debris Disposal Area in the WTA. **(2) Containment** of PDA; the TCE Source area within the former Rubber Chemicals Manufacturing Area within the PA; and the Old Nitro Dump / Waste Pond within the WTA; Containment to consist of **Barrier Walls** and **Low Permeability Caps (compliant with WV33CSR1-Subtitle C)** over the PDA; Pumping within the contained area to maintain inward gradient with on-site or off-site groundwater treatment; and pumping of LNAPL within the PDA with off-site treatment. **(3) Institutional controls** restricting site uses to non-residential and prohibiting groundwater extraction for all reasons except monitoring. **(4) Monitor** COC mass flux to the river.
	Groundwater	**2)** Control Site sources and monitor TCDD, PCE, TCE, DCE and VC concentrations in groundwater to confirm improvement over time following Interim Measures implementation.. **3)** Control Site groundwater use until long-term CMOs are achieved.	**2)** Control migration of TCDD to the Kanawha River via the groundwater pathway such that the sum from all Site sources is below the "safe loading level"[2] for the Site. **3)** Control migration of PCE and its breakdown products to the Kanawha River via the groundwater pathway to a level that is protective of surface water quality.	
	Stormwater	**4)** Maintain compliance with the NPDES Permit[1]	**4)** Control migration of TCDD to the Kanawha River via the stormwater pathway such that the sum from all Site sources is below the "safe loading level"[2] for the Site.	
Area 2 - Former Manufacturing Areas	**Stormwater**	**5)** Maintain compliance with the NPDES Permit[1]	**5)** Prevent exposures of Site users and trespassers to soils. **6)** Control migration of TCDD to the Kanawha River via the stormwater pathway such that the sum of all Site sources is below the "safe loading level"[2] for the Site.	**(5) Permanent , permeable covers** - All areas of the Site without Low Permeability Caps (compliant with WV33CSR1-Subtitle C) or Low Permeability Covers will receive permanent, permeable covers. **(6) Monitor** COC mass flux to the river.
Area 3 - Non-Manufacturing Areas	**Soils**	**6)** Implement Site Health and Safety Plan and Site security procedures to prevent exposure of industrial and construction workers and trespassers to Area 3 soils prior to and during the construction of Interim Measures.	**7)** Prevent exposures of current and future Site users and trespassers to soils.	**7)** Same as Interim Measures No. 5 and No. 6 above.
Area 4 - Riverbank	**Soils**	**7)** Implement Site Health and Safety Plan and Site security procedures to prevent exposure of industrial and construction workers and trespassers to Area 4 soils prior to and during the construction of Interim Measures.	**8)** Prevent exposures of current and future Site users and trespassers to soils	**8) Riprap Armoring** of the entire river bank in the former Process Area and over approximately the southern 2/3 rds of the former WTA river bank.
Riverbank - Along Site boundary	**Aquatic Sediments adjacent to the Site** (post-New Monsanto clean-up)	**8)** Prevent COC re-entrainment and transport off-site by Site stormwater	**9)** Protect aquatic sediments adjacent to the Site by reduction in COC transport via improvements in groundwater and surface water quality pursuant to IMOs 2, 3 and 4 above.	**9)** IMs 1 thru 9 above
Sitewide Groundwater	**Groundwater**	**9)** Monitor groundwater downgradient of the Former Rubber Chemicals Manufacturing Area and the Wastewater Treatment Area	**10)** Determine if the Interim Measures are capable of achieving State and Federal groundwater cleanup criteria[3] or what additional actions are required for final RCRA Corrective Measures	**(10) Additional Monitoring wells and Long-Term Monitoring** - Annual PCE, TCE, DCE and VC monitoring in three well pairs downgradient of the Former 2,4,5-T Manufacturing Area and the Former Rubber Chemicals Manufacturing Area (GW-4 and 5 and newly constructed well pair adjacent to NE corner of closed Firewater Lagoons). Annual TCDD TEQ monitoring in two well pairs downgradient of the WTA Impoundments (GW-18 and 19)

[1] It is anticipated that an NPDES permit will not be required following Interim Measures implementation.

[2] "Safe Load Level" for the Site established in the TMDL Report: "Dioxin TMDL Development for Kanawha River, Pocatalico River and Armour Creek, West Virginia", dated September 14, 2000, prepared for U.S EPA Region III by Tetra-Tech, Inc.

[3] Achievement of groundwater cleanup criteria will require reasonable efforts to eliminate or mitigate further releases of contaminants from SWMUs, impoundments and affected soils and reduction of contaminant levels, as practicable, over time, to support reasonably expected use. These criteria may include the implementation of institutional and/or engineering controls.

Area 1 - Source Areas: Former 2,4,5-T Manufacturing Area, Former Rubber Chemicals Manufacturing Area and Past Disposal Area in the Process Area and the Old Nitro Dump; 2,4,5-T Demolition Debris Area, Waste Pond, Limestone Bed, Surge Basin, Emergency Basin, Equalization Basin and A3 Basin in the Wastewater Treatment Area
Area 2 - "Former Manufacturing Areas" are areas in the PA and WTA - never used directly for manufacturing or disposal - where the IMO is to protect the river from stormwater transport of TCDD and from groundwater transport of COCs.
Area 3 - "Potentially Clean Land" area areas of the PA and WTA which have never been associated with manufacturing or disposal activities.
Area 4 - Riverbank: The riverbank adjacent to the PA and the southern 2/3rds of the WTA.

4.2 Proposed Interim Measures

The Site RFI[5] and ERFI[6], conducted in 1995 and 2006 respectively, have resulted in development of a thorough Site characterization and CSM. The technologies selected as proposed Interim Measures (IMs) have been successfully demonstrated in multiple past remedial actions, and have been shown to be effective engineered and management systems for controlling the migration of Site COCs in soils and groundwater. Installation of the proposed remedies as IMs will provide timely, full-scale demonstrations that the selected technologies will achieve the site specific clean-up objectives. The IM approach is consistent with the Site RCRA Permit[7] and the Advanced Notice of Proposed Rulemaking (ANPR) on "Action for Releases for Solid Waste Management Units at Hazardous Waste Management Facilities", published May 1, 1996, in The Federal Register, Vol. 61, No. 85, pp 19431-19464. Both ANPR and the Site RCRA Permit state that an IM approach may be utilized if warranted by site-specific conditions.

The proposed IMs for all Site areas and environmental media are presented in Table 4-2, "Proposed Interim Measures." Technical specifications for each of the IMs are presented in Table 4-3, "Interim Measures Technical Specifications." Figures 4.1 and 4.2 visually display on Site maps the types and locations for all proposed IMs.

4.2.1 Projected Effectiveness of Proposed Interim Measures

It is estimated that implementation of the proposed IMs will reduce the TCDD loading to the river from Site groundwater by 94% from the current low levels, resulting in an average TCDD concentration in Site groundwater discharging to the river of 0.006 pg/L, well below the TMDL target of 0.014 pg/l for the Kanawha River (see Appendix A). The proposed IMs address virtually all Site soils. These caps and covers are projected to reduce the TCDD flux to the River in surface water by 100%. Therefore, the total effect of the proposed IMs is a 99.98% overall reduction in TCDD flux to the River (i.e. from 2.445 ug/day for surface water and 0.00732 ug/day for groundwater to zero for surface water and 0.00043 ug/day for groundwater). Reductions in TCDD flux to the river will be evaluated pursuant to the Interim Measures Effectiveness Monitoring Plan discussed in Section 5.0.

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[5] "RCRA Facility Investigation and Stabilization/ Measure Plan", dated May 5, 1995, and the Addendum, dated August 7, 1995, both by Roux Associates, Inc. The August 7, 1995 Addendum responded to the Agencies' June 16, 1995 Comments on the May 5, RFI Report.

[6] "Expanded RCRA Facility Investigation Report", dated February 16, 2007, Potesta & Associates, Inc., with attachment of USEPA and WVDEP "Draft Comments for the February 16, 2007 Draft Expanded RFI Report", dated August 24, 2007, as approved by letter to Michael House, Solutia Inc. dated April 25, 2008, William Wentworth, USEPA Remedial Project Manager.

[7] RCRA Corrective Action Permit, EPA ID WVD039990965, Part II-Specific Facility Conditions, E. Interim Measures

4.3 Potential Integration of Contiguous Property

Figure 4.1 shows the approximately 2.8-acre Western Parcel of the approximately 12-acre West Virginia Alcoholic Beverage Control Administration (WVABCA) warehousing and distribution facility, which is contiguous to the PDA. The same IM that is proposed for the PDA is a potential IM for this property[8]. Multiple investigations of the Western Parcel indicate that the IM proposed for the PDA would also be protective for the WVABCA Western Parcel. Accordingly, the installation of the barrier wall and cap planned for the PDA could be extended to the Western Parcel and be performed as one integrated project with the PDA IM. In such case, the final location of the barrier wall along the eastern boundary of the Western Parcel as depicted on Figure 4-1 would be determined prior to installation.

Inclusion of the Western Parcel into the PDA IM project would require agreement between New Monsanto and WVABCA on the Western Parcel remediation (i.e. final design; access for investigation and remediation; future access; etc.). If this agreement is not reached in a timely manner (i.e. consistent with the enclosed RCRA Deliverable Schedule for the Solutia Site located in Section 6.0), installation of the PDA IM will proceed independent of the WVABCA Western Parcel remediation.

[8] See Table 4-2 for the PDA IM description and Table 4-3 for detailed IM technical specifications.

TABLE 4-2

Proposed Interim Measures

Type	Media	Site Area	Interim Measures
Institutional Controls	Groundwater/ Soils	Site-Wide	Land use restricted to commercial / Industrial via restrictive covenant[1]
			Prohibition of Groundwater extraction via restrictive covenant for any reason other than monitoring and /or treating
Source Control	Soils and Groundwater	Process Area	Containment of the PCE Source Area within the Former Rubber Chemicals Manufacturing Area with a Barrier Wall and Low-Permeability Cap (WV33CSR1 -Subtitle C). Pumping within contained area to maintain inward gradients with on-site or off-site groundwater treatment
			Low-Permeability Cover over the Former 2,4,5-T Manufacturing area
			Permanent Permeable Cover over remainder of Process Area
		Past Disposal Area	Containment of the PDA with a Barrier Wall and Low-Permeability (WV33CSR1 -Subtitle C) Cap. Pumping within contained area to maintain inward gradient
		Riverbank	Rip-Rap armoring of the exposed PA (~2500 LF) and WTA river bank (southern ~1600 LF).
		Wastewater Treatment Area	Containment of the Old Nitro Dump/Waste Pond with a barrier wall and Low-Permeability Cap (WV33CSR1 - Subtitle C); Pumping within contained area to maintain inward gradients with on-site or off-site groundwater treatment Low-Permeability Cover over 2,4,5-T Building demolition debris; Limestone Bed, Surge Basin, Emergency Basin, Equalization Basin and A3 Basin.
IM Effectiveness Monitoring	Groundwater	Site-Wide	A groundwater flow model will be developed to assess the effects of flow changes from barrier wall construction and to determine the need and optimum location for additional groundwater monitoring wells. Semi-annual sampling of IM effectiveness monitoring wells for Site COCs. Semi-annual Dioxin TEQ sampling of IM Effectiveness Monitoring wells along the Site river boundary. Annual sampling of Site surface water and Kanawha River for Site COCs

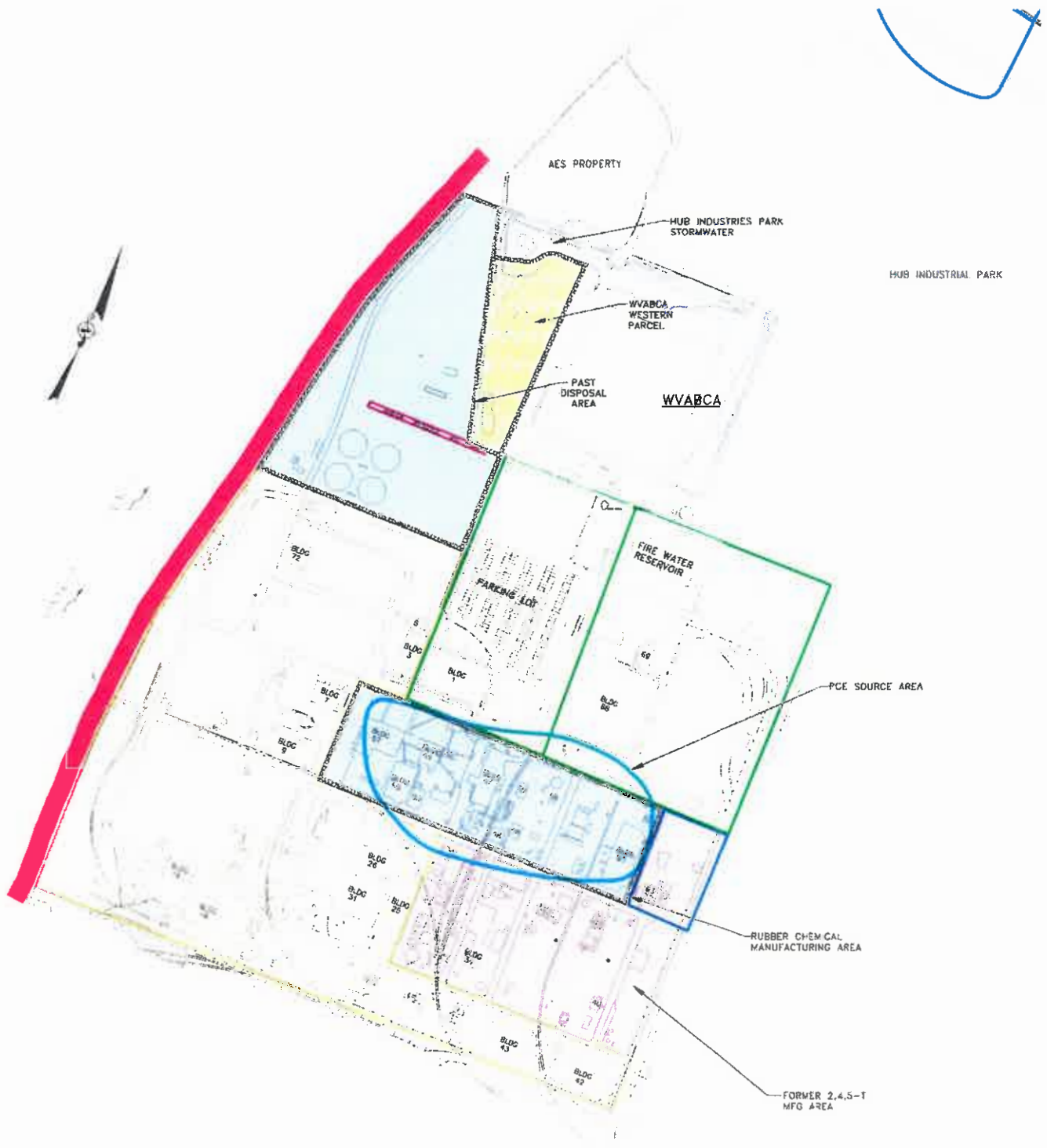
[1] This is an environmental covenant executed pursuant to the Voluntary Remediation and Redevelopment Act, West Virginia Code Chapter 22, Article 22, and the Uniform Environmental Covenants Act, West Virginia Code Chapter 22, Article 22B. The environmental covenant will be acquired after all components of the remedy are constructed and all remedial components finalized. The covenant will map out all constructed engineering controls and associated use-restrictions for those specific units and for site-wide restrictions

Table 4-3

Interim Measures Technical Specifications

IM Type	Applicable Site Area(s)	Specifications
Low Permeability Cap		
	PDA **PA TCE Source Area** **Old Nitro Dump / Waste Pond**	***Compliant with WV 33CSR1 (Subtitle C)***
		° 18" (avg.) bedding layer
		° Geotextile Cushion
		° 40 mil HDPE
		° Composite Drainage Layer
		° Piping over Drainage Layer
		° 18" Vegetative Soil Layer
Low Permeability Cover		
	PA Former 2,4,5-T Manuf. Area	° 8" soil bedding layer
	WTA Impoundments - Emergency Basin - Surge Basin - Equalization Basin - A3 Basin - Limestone Bed	° 40 mil HDPE
		° Geotextile
		° 18" Vegetative Soil Layer
	WTA - 2,4,5-T building demolition debris disposal area	
Permanent, Permeable Cover		
	All areas of the Site without Low Permeability Caps or Low Permeability Covers	° Geotextile
		° 18" Vegetative Soil Layer
Barrier Wall		
	PDA PA TCE Source Area Old Nitro Dump / Waste Pond	Soil / bentonite (~2 %) Slurry Wall
		$1x10^{-7}$cm/sec permeability
		Width ~ 2-3 ft.
		Depth - ~ 55-60 ft. to impervious strata
		Keyed ~ 3 ft into underlying impervious strata
River Bank Armoring w/ Rock Riprap		
	PA Riverbank (~ 2500 LF) Southern WTA Riverbank (~ 1600 LF)	Commercially Purchased Limestone
		Hard. durable limestone w/ d50 of 12"
		Rock size range of 6" min. to ≤ 18" max. with ≤ 6% by weight < 6"
		≤ 30% weight loss when subjected to 5 cycles of Sodium Sulfate Soundness Test - ASTM C88-99a Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate as modified by the American Association of State Transportation Officials (AASHTO) T-104

PA – PROPOSED INTERIM MEASURES



LEGEND

CAPS & COVERS

- LOW PERMEABILITY CAP (WV33CSR-1)
- PERMANENT – PERMEABLE COVER
- LOW PERMEABILITY COVER
- RIVERBANK ARMORING

GROUNDWATER

- GROUNDWATER CONTAINMENT

CONTIGUOUS PROPERTY

- WVABCA WESTERN PARCEL

GRAPHIC SCALE

200 100 0 200

MAPPING REFERENCES:
BASE MAPPING PREPARED BY PHOTO SCIENCE, INC. FROM AERIAL PHOTOGRAPHY DATED 3/17/95.
SUBSEQUENT REVISIONS COMPLETED BY FLEXSYS AMERICA LP.

2009_FIG 4-1
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Approved

NOT TO SCALE
Scale:

OCTOBER 2009
Date:

01-00B1-700A
Project No

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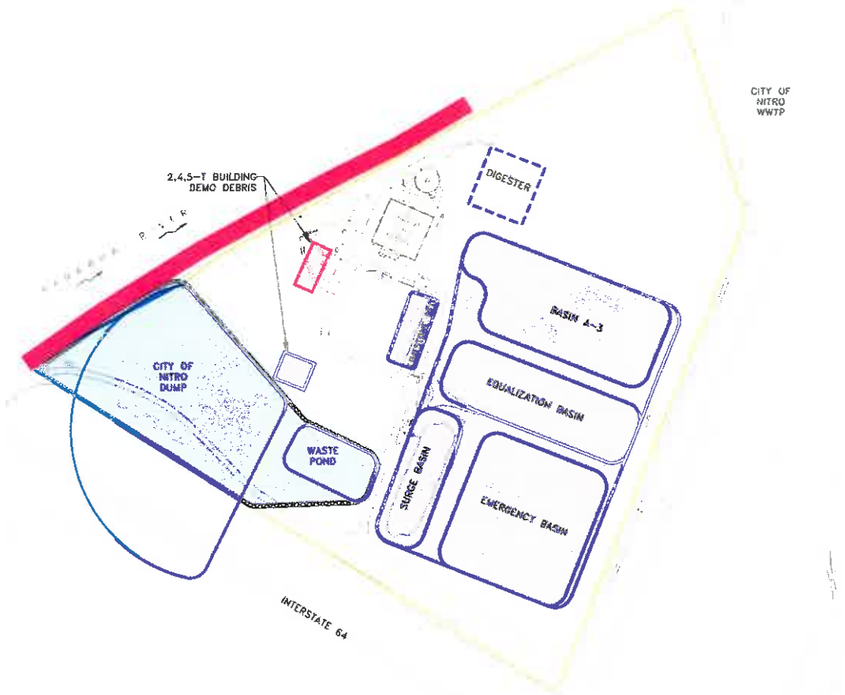
POTESTA

SOLUTIA NITRO SITE
NITRO, WEST VIRGINIA

PROCESS AREA
INTERIM MEASURES

4.1
Figure No.

WTA – PROPOSED INTERIM MEASURES



LEGEND

CAPS & COVERS

- LOW PERMEABILITY CAP (WVCSR33-1)
- PERMANENT – PERMEABLE COVER
- LOW PERMEABILITY COVER
- RIVERBANK ARMORING

GROUNDWATER

- GROUNDWATER CONTAINMENT

GRAPHIC SCALE

200 100 0 200 400

MAPPING REFERENCE
BASE MAPPING PREPARED BY PHOTO SCIENCE, INC FROM AERIAL PHOTOGRAPHY DATED 2/17/95.
SUBSEQUENT REVISIONS COMPILED BY PLANSYS AMERICA LLC

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SEPT. 2009
Date
01-0081-700A
Project No.

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POTESTA

SOLUTIA NITRO SITE
NITRO, WEST VIRGINIA

WASTEWATER TREATMENT AREA
INTERIM MEASURES

4.2
Figure No.

5.0 INTERIM MEASURES EFFECTIVENESS MONITORING PLAN

5.1 Objectives

The Interim Measures Effectiveness Monitoring Plan (IM-EMP) is a multi-year monitoring and evaluations plan to be initiated upon completing the installation of all IMs. The overall purpose of the IM-EMP can be defined in three timeframes:

1. Confirm that the IMs are initially functioning consistent with the design specifications.
2. In the intermediate timeframe, provide sufficient data to evaluate the rate of improvement of Site environmental media relative to the media objectives (see Table 4-1).
3. Longer term, provide data which can be used to assess the adequacy of the IMs toward achievement and maintenance of the long-term Site media objectives and long-term, permanent protection of Human Health & the Environment.

The long-term objective of the IM-EMP will be to determine if additional measures will be required to achieve State and Federal groundwater cleanup criteria.

5.2 Sampling and Inspections

The IM-EMP will consist of the following periodic activities with the analytical results to be reported on an annual basis:

- Annual inspection of all Caps and Covers
- Annual assessment of all Institutional Controls for completeness and Site compliance
- Semi-annual sampling of all groundwater IM-EMP Monitoring Wells
  a) Analysis for Site COCs
  b) Calculation of COC mass flux to the river
- Semi-annual sampling of the Kanawha River surface water for Site COCs
  a) Comparison of water column COC concentrations to WVAWQC where available; comparison with other criteria where appropriate
- Annual Site surface water sampling and analysis for Site COCs

Table 5-1 presents a summary of the IM-EMP as they relate to Site IMOs.

Figure 5.1 displays a map of the Site IMs illustrated and IM-EMP Monitoring Well locations.

5.3 Reporting

Beginning with the first full year following completion of the installation of all IMs, annual IM-EMP reports will begin. The annual IM-EMP report will summarize the sampling and inspection results from the previous year and assess progress toward achievement of IMOs. The annual IM-EMP report will be submitted in the first quarter of each year for the prior year report period.

TABLE 5-1

Interim Measures Effectivness Monitoring Plan Summary
Solutia Inc. - Nitro, WV Site

AREA	Environmental Media	Interim Measures Objectives (IMOs)		Interim Measures Effectiveness Monitoring Plan
		Short-Term	*Intermediate / Long-Term*	
Area 1 - Source Areas	Soil/wastes	**1)** Implement Site Health and Safety Plan and Site security procedures to prevent exposure of industrial and construction workers and trespassers to source area soils and wastes prior to and during the construction of Interim Measures.	**1)** Prevent exposures of current and future Site users and trespassers to soils and wastes	1) Annual Inspection of all caps & covers; 2) Annual assessment of all Institutional Controls for completeness and Site compliance
	Groundwater	**2)** Control Site sources and monitor TCDD, PCE, TCE, DCE and VC concentrations in groundwater to confirm improvement over time following Interim Measures implementation.. **3)** Control Site groundwater use until long-term CMOs are achieved.	**2)** Control migration of TCDD to the Kanawha River via the groundwater pathway such that the sum from all Site sources is below the "safe loading level"[2] for the Site. **3)** Control migration of PCE and its breakdown products to the Kanawha River via the groundwater pathway to a level that is protective of surface water quality.	3) Annual groundwater sampling of all IM Effectiveness Monitoring Wells[3] / analysis for Site COCs / calculation of COC mass flux to river; 4) Annually sampling of Kanawha River surface water for Site COCs[4]
	Stormwater	**4)** Maintain compliance with the NPDES Permit[1]	**4)** Control migration of TCDD to the Kanawha River via the stormwater pathway such that the sum from all Site sources is below the "safe loading level"[2] for the Site.	5) Annual Site surface water sampling and analysis for Site COCs;
Area 2 - Former Manufacturing Areas	Stormwater	**5)** Maintain compliance with the NPDES Permit[1]	**5)** Prevent exposures of Site users and trespassers to soils. 5.a) Control migration of TCDD to the Kanawha River via the stormwater pathway such that the sum of all Site sources is below the "safe loading level"[2] for the Site.	
Area 3 - Non-Manufacturing Areas	Soils	**6)** Implement Site Health and Safety Plan and Site security procedures to prevent exposure of industrial and construction workers and trespassers to Area 3 soils prior to and during the construction of Interim Measures.	**6)** Prevent exposures of current and future Site users and trespassers to soils.	See Item 1 above.
Area 4 - Riverbank	Soils	**7)** Implement Site Health and Safety Plan and Site security procedures to prevent exposure of industrial and construction workers and trespassers to Area 4 soils prior to and during the construction of Interim Measures.	**7)** Prevent exposures of current and future Site users and trespassers to soils	See Item 1 above.
Sitewide Groundwater	Groundwater	**8)** Monitor groundwater downgradient of the Former Rubber Chemicals Manufacturing Area and the Wastewater Treatment Area	**9)** Determine if the Interim Measures are capable of achieving State and Federal groundwater cleanup criteria[3], and: **10)** If not, what additional actions are required for final RCRA Corrective Measures	See Item 3 above.
Reporting				f) Comprehensive Effectiveness Monitoring Report summarizing monitoring results and assessing progress toward achievement of IMOs – due annually in 1Q for preceding year.

[1] It is anticipated that an NPDES permit will not be required following Interim Measures implementation and a demonstration period.

[2] "Safe Load Level" for the Site established in the TMDL Report: "Dioxin TMDL Development for Kanawha River, Pocatalico River and Armour Creek, West Virginia", dated September 14, 2000, prepared for U.S EPA Region III by Tetra-Tech, Inc.

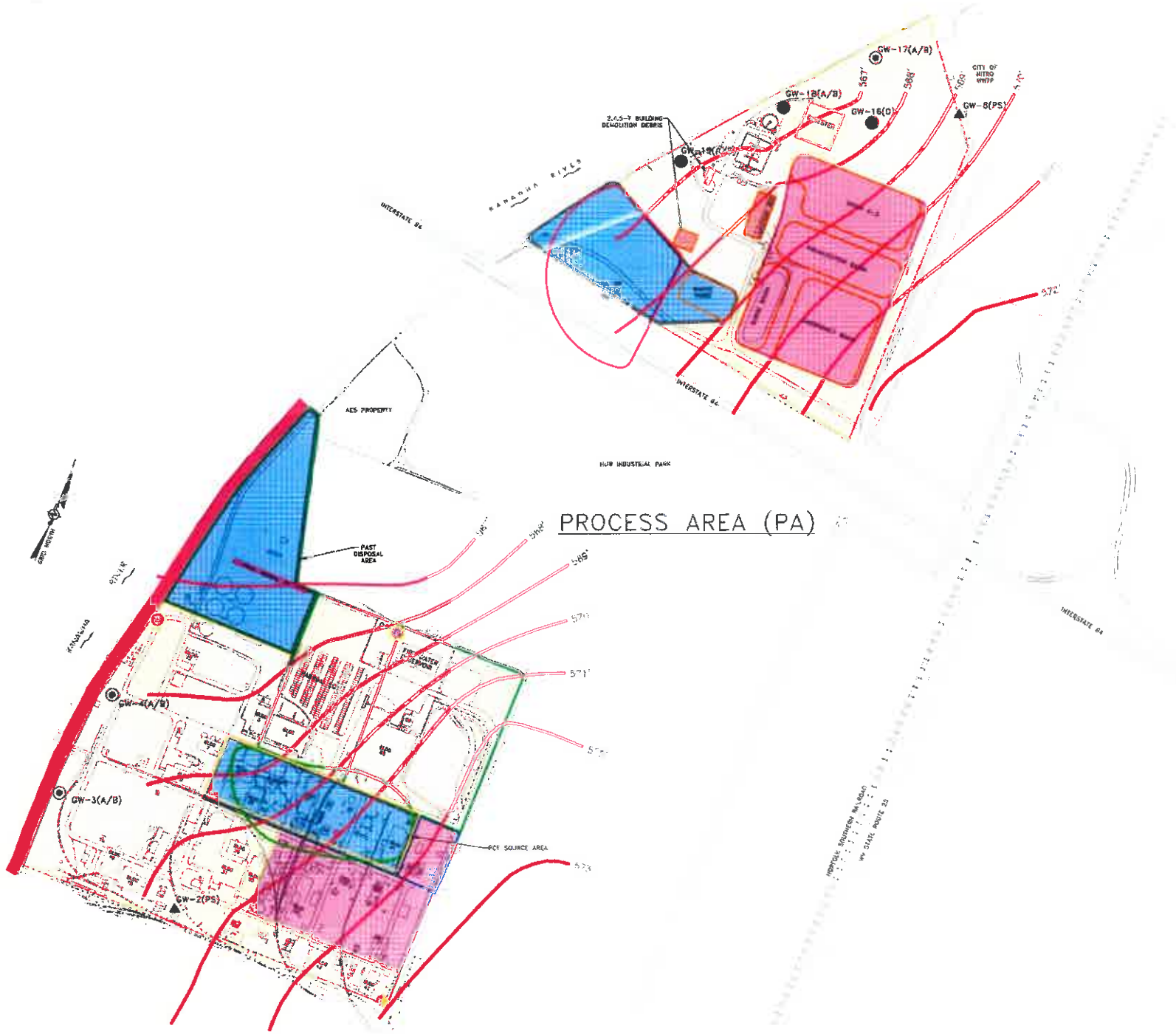
[3] See Figure XXX "IM Effectiveness Monitoring Wells" for well locations

[4] The IM Monitoring point will be in the river along the site bank.

[5] Achievement of groundwater cleanup criteria will require reasonable efforts to eliminate or mitigate further releases of contaminants from SWMUs, impoundments and affected soils, and reduction of contaminant levels, as practicable, over time, to support reasonably expected use. These criteria may include the implementation of institutional and/or engineering controls.

INTERIM MEASURES EFFECTIVENESS MONITORING WELLS

WASTEWATER TREATMENT AREA (WTA)



PROCESS AREA (PA)

LEGEND

IM MONITORING WELLS

- NEW PROSONIC WELL CLUSTER
- EXISTING TCDD MITIGATION WELL CLUSTER
- EXISTING PLUME STABILITY/TCDD MIGRATION DUAL USE WELL CLUSTER
- EXISTING PLUME STABILITY WELL CLUSTER
- EXISTING MONITORING WELL
- 573' GROUNDWATER ELEVATION

- LOW PERMEABILITY CAP (WV33CSR-1)
- PERMANENT – PERMEABLE COVER
- LOW PERMEABILITY COVER

GRAPHIC SCALE
200 150 0 200 600

MAPPING REFERENCE:
BASE MAPPING PREPARED BY PHOTO SCIENCE, INC. FROM AERIAL PHOTOGRAPHY DATED 2/17/95.
SUBSEQUENT REVISIONS COMPLETED BY FLEXSYS AMERICA L.P.

2009 FIG 5.1
CAD File No.
BEL
Drawn
DML
Checked
DML
Approved
NOT TO SCALE
Scale
OCTOBER 2009
Date
01-0081-700A
Project No.

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ENGINEERING AND ENVIRONMENTAL CONSULTANTS
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POTESTA

SOLUTIA NITRO SITE
NITRO, WEST VIRGINIA

MIGRATION TO KANAWHA RIVER
VIA GROUNDWATER PATHWAY

5.1
Figure No.

6.0 INTERIM MEASURES WORK PLAN SUMMARY / SCHEDULE

6.1 Scope of Work

Work to be performed pursuant to this IM Work Plan – including the IM-EMP – are summarized as follows:

i. The following activities will precede installation of the barrier walls (i.e. Item ii):
   a) A geological investigation along the 3 barrier wall pathways to determine depth to B/R and overburden/bedrock characterization;
   b) Excavation and clearing of the barrier wall pathway of all physical obstructions/debris;
   c) Completion of needed agreements among all responsible parties involved with the WVABCA Parcel B incorporation into the PDA IM;
   d) Final delineation of the extent of cap and barrier wall pathway for incorporation of WVABCA Parcel B into the PDA IM;
   e) Completion of needed agreements among responsible parties involved with the HUB Industrial Park Drainway project and installation prior to or in conjunction with the PDA IM.

ii. Installation of three groundwater barrier walls totaling approximately 8000 LF.
   a) PA - PCE Source Area;
   b) PDA;
   c) WTA - Old Nitro Dump and Waste Pond.

iii. Installation of two (2) additional IM Effectiveness Monitoring Well pairs.

iv. Installation of approximately 122 acres of Site Caps and Covers as detailed in Tables 4-1, "Interim Measures; and Table 4-2, "Interim Measures Technical Specifications."

v. Riverbank clearing, grading and armoring.
   a) PA – 2500 LF;
   b) WTA – Southern 1600 LF.

vi. Institutional Controls
   a) Land use restricted to commercial / Industrial through the implementation of restrictive covenants that meet West Virginia requirements[9];

[9] An environmental covenant executed pursuant to the Voluntary Remediation and Redevelopment Act, West Virginia Code Chapter 22, Article 22, and the Uniform Environmental Covenants Act, West Virginia Code Chapter 22, Article 22B

b) Prohibition of groundwater extraction for any purpose other than monitoring through the implementation of restrictive covenants that meet West Virginia requirements.

Detailed design plans for the barrier walls, Caps and Covers will be submitted for review and approval pursuant to the enclosed schedule (See Tab 6.0 Schedule).

6.2 Schedule

The RCRA Deliverable Schedule on the following page reflects the following key completion milestones:

o	IM Work Plan approval	04/29/10
o	Barrier wall(s) investigation/clearing	12/2010
o	Barrier wall(s) installations	04/2012
o	Site Cover Installations	01/2015

6.3 Reporting

During the multiyear IM construction period (2010 – 2014), progress reports and future plans will be submitted to the Agencies on a quarterly basis by the 20th of the month following each quarter. Quarterly reports will be due: January 20, April 20, July 20, and October 20. In addition, it is anticipated that occasional progress meetings, site visits with USEPA and WVDEP will take place as well.

04-09-10 RCRA Deliverable Schedule

ID	Task Name	Duration	Start	Finish	Predecessors
2					
3	**Flexsys Demolition**	**412 days**	**Fri 4/9/04**	**Mon 11/7/05**	
8	**Soils Stabilization Plan - PA / WWTP & Site Handoff**	**296 days**	**Wed 10/6/04**	**Wed 11/23/05**	
17	**CA-750 EI**	**576 days**	**Mon 4/19/04**	**Mon 7/3/06**	
22	**CA-725 EI**	**477 days**	**Mon 10/18/04**	**Tue 8/15/06**	
26	**Expanded - RFI (Groundwater)**	**540 days**	**Wed 10/6/04**	**Tue 10/31/06**	
35	**Abandonment of GW wells / TCE Rec system shutdown**	**39 days**	**Wed 10/6/04**	**Mon 11/29/04**	
41	**Expanded - RFI (Soils & SWMUs)**	**507 days**	**Wed 10/6/04**	**Thu 9/14/06**	
46	**Expanded RFI Report**	**647.5 days**	**Wed 11/15/06**	**Fri 5/8/09**	
72	**Corrective Measures Study (CMS)**	**434 days**	**Mon 9/1/08**	**Thu 4/29/10**	
73	Develop & Submit CMS Work Plan	1 mon	Mon 9/1/08	Fri 9/26/08	
74	**Agencies Draft Comments to Solutia**	39 days	Mon 9/29/08	Thu 11/20/08	73
75	**Solutia Reviews Draft Comments / Schedule Review Meeting**	7.8 wks	Mon 9/29/08	Thu 11/20/08	
76	Meet to discuss Agency Draft Comments	1 day	Wed 7/22/09	Wed 7/22/09	75
77	Submit revised Work Plan as Interim Measures Work Plan	9.3 mons	Thu 7/23/09	Thu 4/8/10	76
78	Interim Measures Work Plan- Agencies' Review / Comment / Approval	3 wks	Fri 4/9/10	Thu 4/29/10	77
79					
80	**Implement Interim Measures**	**1240 days**	**Fri 4/30/10**	**Thu 1/29/15**	**78**
81					
82	**GW Barrier Walls (3) Installation**	**520 days**	**Fri 4/30/10**	**Thu 4/26/12**	
83					
84	**Pre-design geological investigation**	**60 days**	**Fri 4/30/10**	**Thu 7/8/10**	**78**
85	Submit Work Plan for Approval	1 wk	Fri 4/30/10	Thu 5/6/10	
86	Receive Agencies' Approval	1 wk	Fri 5/7/10	Thu 5/13/10	85
87	Implement investigation / receive results	2 mons	Fri 5/14/10	Thu 7/8/10	86
88					
89	**WVABCA Parcel B**	**100 days**	**Fri 4/30/10**	**Thu 9/16/10**	
90	Finalize Agreements to Include Parcel B Within PDA Interim Measure	3 mons	Fri 4/30/10	Thu 7/22/10	77
91	Select Final Barrier Wall Location along Parcel B Eastern Boundary	2 mons	Fri 7/23/10	Thu 9/16/10	90
92					
93	**HUB Industrial Park Stormwater Drainway**	**420 days**	**Fri 4/30/10**	**Thu 12/8/11**	**78**
94	Finalize project scope and agreements	6 mons	Fri 4/30/10	Thu 10/14/10	
95	Design / bid / select contractor / mobe / install Drainway / demobe	15 mons	Fri 10/15/10	Thu 12/8/11	94
96					
97	**Barrier Wall Pathway Clearing - RFP / Contractor Selection / implementation**	**150 days**	**Fri 4/30/10**	**Thu 12/9/10**	**78**
98	Project design & approval / RFP development / Contractor selection	3 mons	Fri 4/30/10	Thu 7/22/10	
99	Barrier Wall Pathway Clearing	5 mons	Fri 7/23/10	Thu 12/9/10	98,87
100					
101	**Barrier Walls (3) Installation**	**360 days**	**Fri 12/10/10**	**Thu 4/26/12**	**99**
102	Project Design / RFP Development / Contractor Selection	6 mons	Fri 12/10/10	Thu 5/26/11	
103	**Install ~ 7500 LF of Slurry Walls**	**240 days**	**Fri 5/27/11**	**Thu 4/26/12**	**102**
104	Mobe & Install Barrier around TCE Source Area	3 mons	Fri 5/27/11	Thu 8/18/11	
105	Install Barrier Wall around PDA	2 mons	Fri 12/9/11	Thu 2/2/12	104,95
106	Install Barrier Wall around Old Nitro Dump and Waste Pond-demobe	3 mons	Fri 2/3/12	Thu 4/26/12	105
107					
108	**Site Covers Design and Installation**	**720 days**	**Fri 4/27/12**	**Thu 1/29/15**	
109	PA - Impermeable and Permeable Covers	18 mons	Fri 4/27/12	Thu 9/12/13	101
110	River Bank Armoring	18 mons	Fri 4/27/12	Thu 9/12/13	101
111	WWTP - Impermeable and Impermeable Covers	18 mons	Fri 9/13/13	Thu 1/29/15	110
112					
113	**RELATED PROJECTS**	**1380 days**	**Tue 1/1/08**	**Mon 4/15/13**	
114					
115	**SOLUTIA SITE REDEVELOPMENT**	**1320 days**	**Tue 1/15/08**	**Mon 2/4/13**	
116	Development of Redevelopment Master plan	36 mons	Tue 1/15/08	Mon 10/18/10	
117	Coordinate Solutia Site Interim Measures and Redevelopment	30 mons	Tue 10/19/10	Mon 2/4/13	116
118					
119	**KANAWHA RIVER SITE ASSESSMENT**	**1380 days**	**Tue 1/1/08**	**Mon 4/15/13**	
120	Coordinate River Sediment project with Solutia Site interim Measures	69 mons	Tue 1/1/08	Mon 4/15/13	

7.0 CLOSING

This report has been prepared to assist Solutia in evaluating the current environmental conditions at the Site. POTESTA and Solutia mutually devised the scope of this study, and is limited to the specific project, location, and time-period described herein. The report represents POTESTA's understanding of the Site conditions as discernible from information provided by others and obtained by POTESTA using the methods specified. POTESTA assumes no responsibility for information provided or developed by others or for documenting conditions detectable with methods or techniques not specified in the scope of services. In addition, no activity, including sampling, assessment or evaluation of material or substance, may be assumed to be included in this study unless specifically considered in the scope of services and this report. Sketches and maps in this report are included only to aid the reader and should not be considered surveys or engineering studies. If additional data concerning this Site become available, POTESTA should be informed so that we may examine the information and, if necessary, modify this report accordingly.

APPENDIX A

Pre-Interim Measures TCDD Flux to River

Pre- Interim Measures - TCDD Flux (average soluble) to Kanawha River via the Groundwater Pathway in 2008				
Basis - 2008 Supplemental Data Collection- Two rounds of high volume Dioxin sampling during 2Q08 and 3Q08				
Groundwater Zone / Site Area	**GW Flow**	**AVG TCDD Conc**	**AVG TCDD Flux**	**COMMENTS**
	gpd	pg/l	ug/day	
A-Shallow Zone Flux				
PA Flux	36	0.055	0.00001	
PDA Flux(avg)	206	0.138	0.00011	
WTA	328	0.552	0.00068	
B-Deep Zone Flux				
PA Flux	7017	0.003	0.00009	
PDA Flux	2447	0.035	0.00033	
WTA	9049	0.178	0.00611	
Total	19,083	0.101	0.00732	
			16.5	TMDL TCDD allocated load (ug/day) to contaminated GW @ 7Q10 Flow- June'98 TMDL, Pg 42
			0.04%	AVG TCDD flux as % of allocated TCDD load

Conversions
3.785412

Basis - 2008 Supplemental Data Collection- Two rounds of high volume Dioxin sampling during 2Q08 and 3Q08							
Wells		**A Aquifer TCDD Conc (pg/L)**			**B Aquifer TCDD Conc (pg/L)**		
		2Q08	**3Q08**	**Average**	**2Q08**	**3Q08**	**Average**
PA	GW-3	0.0004	0.0033	0.055	0.0023	0.0027	0.003
	GW-4		0.16		0.007	0.001	
PDA	GW-9	0.11	0.14	0.138	0.085	0.079	0.035
	GW-10	0.22	0.26		0.009	0.021	
	GW-11	0.031	0.065		0.016	0.0009	
WTA	GW-12	0.0265	0.68	0.552	0.82	0.053	0.178
	GW-13	0.0043	0.0045		0.75	0.0225	
	GW-14		4.7		0.375	0.345	
	GW-19	0.26	0.27		0.008	0.014	
	GW-18	0.052	0.078		0.0008	0.0015	
	GW-17	0.0006	0.0004		0.007	0.0031	

Non-detect - TCDD Conc. = DL/2

Post Interim Measures TCDD Flux to the River

Post Interim Measures - TCDD Flux (average soluble) to Kanawha River via the Groundwater Pathway in 2008				
Basis - 2008 Supplemental Data Collection- Two rounds of high volume Dioxin sampling during 2Q08 and 3Q08				
Groundwater Zone / Site Area	**GW Flow**	**Avg TCDD Conc**	**AVG TCDD Flux**	**COMMENTS**
	gpd	pg/l	ug/day	
A-Shallow Zone Flux				
PA Flux	36	0.055	0.00001	
PDA Flux(avg)	206			
WTA	328	0.110	0.00014	
B-Deep Zone Flux				
PA Flux	7017	0.003	0.00009	
PDA Flux	2447			
WTA	9049	0.006	0.00020	
Total	19,083	0.008	0.00043	TCDD Flux to river in groundwater
			94%	Reduction in TCDD Flux vs. 0.0076 pg/day avg TCDD flux before IMs
			42%	Avg TCDD Conc in GW as percentage of TMDL limit for Kanawha River (0.014 pg/L)
			16.5	TCDD allocated load to GW @ 7Q10 Flow - June '98 TMDL Report, Pg 42
			0.003%	TCDD flux as % of allocated TCDD load

Conversions
3.7854118

Average TCDD concentration in GW Post Interim Measures (i.e. without PDA + Old Nitro Dump)

Wells		A Aquifer TCDD Conc (pg/L)			B Aquifer TCDD Conc (pg/L)		
		2Q08	3Q08	Average	2Q08	3Q08	Average
PA	GW-3	0.0004	0.0033	0.055	0.0023	0.0027	0.003
	GW-4		0.16		0.007	0.001	
PDA	GW-9 GW-10 GW-11	Eliminated with containment of PDA					
WTA	GW-12 GW-13 GW-14	Eliminated with containment of Old Nitro Dump					
	GW-19	0.26	0.27	0.110	0.008	0.014	0.006
	GW-18	0.052	0.078		0.0008	0.0015	
	GW-17	0.0006	0.0004		0.007	0.0031	

2008 Supplmental Data Collection

2Q08 Dioxin Results
Round 1

Task Code			GW-3A-2Q08		GW-3B-2Q08		GW-4A-2Q08	GW-4B-2Q08		GW-9A-2Q08		GW-9B-2Q08		GW-10A-2Q08		GW-10B-2Q08		GW-11A-2Q08		GW-11B-2Q08		GW-12A-2Q08	
Sample ID			Insoluble	Soluble	Insoluble	Soluble	(DRAB)	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble
Chemical Name	EPA-TEF	Unit																					
1,2,3,4,6,7,8-HpCDD	0.01	pg/l	ND	ND	ND	ND	160	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	0.01	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8,9-HpCDF	0.01	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HxCDD	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-HxCDD	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PeCDF	0.05	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PeCDD	0.5	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6,7,8-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,7,8-PeCDF	0.5	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
2,3,7,8-TCDD	1	pg/l	ND[.01]	ND[.0008]	ND[.0008]	ND[.0046]	ND[4.9]	ND[.012]	ND[.014]	ND[.0086]	0.11	0.072	0.085	0.068	0.22	0.02	ND[.018]	ND[.048]	ND[.062]	ND[.017]	ND[.012]	0.06	0.053
2,3,7,8-TCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
OCDD	0.001	pg/l	0.89	ND	ND	0.1	1200	ND	0.43	ND	ND	0.14	ND	0.44	N/A	0.16	ND	ND	ND	ND	0.11	ND	0.32
OCDF	0.001	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	N/A	ND	ND	ND	ND	ND	ND	ND	ND
Total TEQ		pg/l	0.016	0.0028	0.0011	0.0039	12	0.016	0.021	0.0064	0.13	0.079	0.086	0.07	0.22(1)	0.021	0.0097	0.073	0.075	0.019	0.016	0.064	0.062

Detection

(1) Test America could only quantitate TCDD and TCDF due to matrix interference

TEF - Toxicity Equivalent Factor

TEQ - Based on EPA TEF system with the value for non-detects equal to DL/2

A - Upper Aquifer
B- Lower Aquifer

Insoluble - Concentration from extractant from 1-Micron filter

Soluble - Concentration of extractant from XAD resin

2008 Supplmental Data Collection

2Q08 Dioxin Results
Round 1

Task Code			GW-12B-2Q08		GW-13A-2Q08		GW-13B-2Q08		GW-14A-2Q08	GW-14B-2Q08		GW-17A-2Q08		GW-17B-2Q08		GW-18A-2Q08		GW-18B-2Q08		GW-19A-2Q08		GW-19B-2Q08	
Sample ID			Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	(SRAB)	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble
Chemical Name	EPA-TEF	Unit																					
1,2,3,4,6,7,8-HpCDD	0.01	pg/l	ND	ND	ND	ND	ND	ND	51	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	0.01	pg/l	ND	ND	ND	ND	ND	ND	64	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8,9-HpCDF	0.01	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HxCDD	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	27	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-HxCDD	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PeCDF	0.05	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PeCDD	0.5	pg/l	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6,7,8-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,7,8-PeCDF	0.5	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,7,8-TCDD	1	pg/l	ND[.010]	0.82	ND[.0016]	ND[.0086]	ND[.016]	ND[1.5]	26	ND[.014]	ND[.23]	ND[.0017]	[.0012]	ND[.0078]	ND[.014]	0.054	0.052	ND[.0018]	ND[.0016]	0.27	0.26	ND[.016]	ND[.016]
2,3,7,8-TCDF	0.1	pg/l	ND	ND	ND	0.043	ND	ND	ND	ND	0.016	ND	ND	ND	ND	ND	0.013	ND	ND	ND	ND	ND	ND
OCDD	0.001	pg/l	ND	0.34	ND	ND	ND	ND	220	ND	ND	ND	ND	ND	ND	2	0.42	ND	0.16	0.53	0.6	ND	ND
OCDF	0.001	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.15	ND	ND	ND	ND	ND	ND
Total TEQ		pg/l	0.018	0.86	0.0035	0.023	0.52	1	44	0.015	0.18	0.0018	0.0013	0.016	0.026	0.063	0.064	0.0022	0.0021	0.27	0.27	0.025	0.025

Detection

TEF - Toxicity Equivalent Factor

TEQ - Based on EPA TEF system with the value for non-detects equal to DL/2

A - Upper Aquifer
B - Lower Aquifer

Insoluble - Concentration from extractant from 1-Micron filter

Soluble - Concentration of extractant from XAD resin

2008 Supplemental Data Collection

3Q08 Dioxin Results
Round 2

Task Code			GW-3A-3Q08		GW-3B-3Q08		GW-4A-3Q08		GW-4B-3Q08		GW-9A-3Q08		GW-9B-3Q08		GW-10A-3Q08		GW-10B-3Q08		GW-11A-3Q08		GW-11B-3Q08		GW-12A-3Q08	
Sample ID			Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble
Chemical Name	EPA-TEF	Unit																						
1,2,3,4,6,7,8-HpCDD	0.01	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.066	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,6,7,8-HpCDF	0.01	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8,9-HpCDF	0.01	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HxCDD	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-HxCDD	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PeCDF	0.05	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PeCDD	0.5	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	0.066	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.078
2,3,4,6,7,8-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,7,8-PeCDF	0.5	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,7,8-TCDD	1	pg/l	ND[.0032]	ND[.0066]	ND.0012]	ND[.0054]	0.45	0.16	ND[.0016]	ND[.002]	0.17	0.14	0.081	0.079	0.45	0.26	ND[.003]	0.021	0.13	0.065	ND[.0092]	ND[.0018]	0.11	0.68
2,3,7,8-TCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01
OCDD	0.001	pg/l	1.5	0.74	0.13	0.1	26	11	ND	ND	0.14	0.96	0.19	ND	1.3	ND	ND	ND	5	0.52	0.3	0.14	0.49	0.51
OCDF	0.001	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total TEQ		pg/l	0.0099	0.0092	0.002	0.0046	0.53	0.19	0.0024	0.0032	0.21	0.16	0.067	0.063	0.47	0.26	0.0024	0.022	0.14	0.074	0.0075	0.0029	0.15	0.79

Detection

TEF - Toxicity Equivalent Factor

TEQ - Based on EPA TEF system with the value for non-detects equal to DL/2

A - Upper Aquifer
B- Lower Aquifer

Insoluble -Analysis of extractant from 1-Micron filter

Soluble - Analysis of extractant from XAD resin

2008 Supplemental Data Collection

3Q08 Dioxin Results
Round 2

Task Code			GW-12B-3Q08		GW-13A-3Q08		GW-13B-3Q08		GW-14A-3Q08		GW-14B-3Q08		GW-17A-3Q08		GW-17B-3Q08		GW-18A-3Q08		GW-18B-3Q08		GW-19A-3Q08		GW-19B-3Q08	
Sample ID			Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble	Insoluble	Soluble
Chemical Name	EPA-TEF	Units																						
1,2,3,4,6,7,8-HpCDD	0.01	pg/l	ND	ND	ND	ND	ND	ND	ND	6.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01
1,2,3,4,6,7,8-HpCDF	0.01	pg/l	ND	ND	ND	ND	0.067	ND	ND	3.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8,9-HpCDF	0.01	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HxCDD	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,4,7,8-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDD	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	1.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,6,7,8-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-HxCDD	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	1.3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8,9-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PeCDF	0.05	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,3,7,8-PeCDD	0.5	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,6,7,8-HxCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,4,7,8-PeCDF	0.5	pg/l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,3,7,8-TCDD	1	pg/l	ND[.0072]	0.053	ND[.0094]	ND[.009]	0.11	ND[.045]	0.76	4.7	ND[.02]	ND[.69]	ND[.0006]	ND[.0008]	ND[.011]	ND[.0062]	0.12	0.078	ND[.0026]	ND[.003]	0.25	0.27	0.046	0.014
2,3,7,8-TCDF	0.1	pg/l	ND	ND	ND	ND	ND	ND	ND	0.26	ND	ND	ND	ND	ND	ND	ND	0.021	ND	ND	ND	ND	ND	ND
OCDD	0.001	pg/l	ND	ND	ND	ND	1.5	ND	2	32	0.23	ND	ND	ND	ND	ND	0.43	ND	ND	ND	1.4	0.31	0.14	0.2
OCDF	0.001	pg/l	ND	ND	ND	ND	ND	ND	ND	5.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total TEQ		pg/l	0.011	0.063	0.011	0.018	0.12	0.039	0.84	5.6	0.026	0.071	0.001	0.0012	0.019	0.034	0.12	0.089	0.0041	0.0039	0.25	0.28	0.049	0.016

Detection

TEF - Toxicity Equivalent Factor

TEQ - Based on EPA TEF system with the value for non-detects equal to DL/2

A - Upper Aquifer
B- Lower Aquifer

Insoluble -Analysis of extractant from 1-Micron filter

Soluble - Analysis of extractant from XAD resin